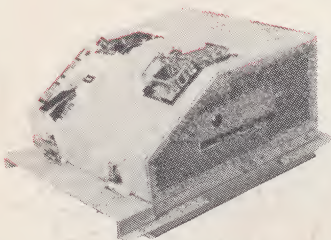


Aug 77

NCE GIANT MINI/MICRO CATALOG

The Best Value We Have Ever Offered

- 50 cps Reader/Punch
- Brand New!
- Original Cost \$1,800



See page 34

Only \$295.

BRAND NEW!

DATA GENERAL COMPUTERS.

with Auto Program Load, Power Monitor and Autostart

NOVA 1200 8K \$2,890

NOVA 1200 Jumbo 8K \$3,540

See page 19

34 pages of Microcomputers, pages 35-68

DEC PDP-11 MEMORY

MM11-K, 4K \$350.00

MM11-L, 8K \$1,100.00

and others

See page 12

New DEC-LSI-11's

at a discount.

page 48



Quick Delivery

on DEC DL11, DR11C, and KL8-Replacements.

See pages 10&15

Computer Automation SALE!

Up to 50% on Alpha 16' & LSI 2/20's

page 28

We RENT computers.

page 9

NEWMAN COMPUTER EXCHANGE

1250 N. Main St. Ann Arbor, Mi. 48104 (313) 994-3200 twx 810-223-6023

SUMMER

77

DATA GENERAL NEW CRT'S in original box

\$1,375

MODEL 6012 VIDEO TERMINAL

- 80 x 24 Flicker-free display
- Roll, page, page-buffered modes
- Edit Keyboard
- Half/full duplex
- 20 ma/60ma/EIA
- 110 through 4800 baud
- Use with D.G. Controllers 4010, 4023, 4060, 4100, 4255, 4256, 4257, 4258
- Fully software supported by D.G.

LIST \$2,700.00

Data General will service these low-maintenance, high-reliability units.

ALSO IN STOCK FOR IMMEDIATE SHIPMENT:

HAZELTINE TTY-COMPATIBLE DISPLAYS

Asynchronous, half/full duplex, EIA interface. 64 characters, 8-level ASCII transmission.

Model 1000	80 x 12	\$ 795
Model 1200	80 x 24	\$1,195
Model 2000	74 x 27	\$1,395
Model 300	Impact Printer	\$1,950
	Tape Cassette	\$1,095

New Replacements

for many
models of
the PDP-11

Immediate
Delivery



**Disk (10MB) and Con-
troller for DG and DCC
only \$4,900** See page 19

AMAZE YOUR FRIENDS — TURN OFF THE TV COMMERCIALS!

with an
ULTRASONIC
LATCHING
RELAY

for only
\$19.95



Turn radio and TV receivers, lamps, motor-driven doors on and off without having to get up! Simply plug Whistle Switch into any 110 V standard household outlet. Then plug any electrical device (leave appliance turned on), up to 300 watts capacity, into the Whistle Switch. Now, just press the ultrasonic whistle . . . and your TV, lights, etc. immediately go on or off. An invaluable step saving aid as well as a security device. Think of all the possible uses. You may need more than one! Switch: 2 x 2 1/2 x 4 1/2".

Instructions included. Cat. No. ESC-MIS-71555

ORDER NOW!
CALL (313) 994-3200

TOMORROW'S TIME TODAY!



CC-51: Jumbo orange digits display the time. (Digit size is 1-5/8" high). An everchanging starburst pattern indicates seconds. Alarm set to wake you up and a doze bar for that extra 8 minutes of sleep. Available in black.

Cat. No. BMK-ACC- CC51 (Black) **\$21.95**

ODEC/Data 100 Printers

factory refurbished
page 14

DEC Cables at a discount

IMMEDIATE DELIVERY

page 15

WORD PROCESSING EQUIPMENT

- Automatic typewriters.
Dictating equipment.

See page 30

OPTICAL PAGE READERS, JUST \$3,995

page 18



BURROUGHS B 80 34-113 \$20,000

Complete with 32 Kb MOS memory, 4 Kb ROM, variable micrologic, system display panel, eight I/O ports, on-board diagnostics, 8-bit parallel data movement and overlap of fetch and execution of micro-instructions. System includes mag tape cassette drive, 256 character system display, 180 cps matrix printer, 25.6 inch dual pinfeed forms handler, two BSM drives and an A9240-2 160 1pm printer.



TO OUR CUSTOMERS (OLD AND NEW!):

Once again, we have compiled a catalog full of quality items at low prices for you, our customers. In addition, we are pleased to offer quick delivery on some high demand items—in some cases, we can get them to you more quickly than the manufacturer. When you see something you like, call us—we will reserve it for you. If you need something that is not listed, call us—we may have it.

With the publication of this catalog—our largest ever—we want to renew to you our personal commitment to continue and improve our service. Our name is our company's name. Its reputation is our reputation. We intend to protect it.

Our company continues to grow. We feel that a large part of our success is due to your guidance and suggestions. We want to receive any comments or suggestions you might have to help us serve you better.

If you are in Ann Arbor, come see us. Our warehouse facility now includes a retail store featuring microcomputer systems and components for the home hobbyist, a complete line of related books and magazines, and, of course, used computers and terminals. We're sure you will enjoy browsing among the many products that we have in stock.

Centronics 101 Serial Printer

Completely refurbished and repainted. Interfaces are new OEM surplus.

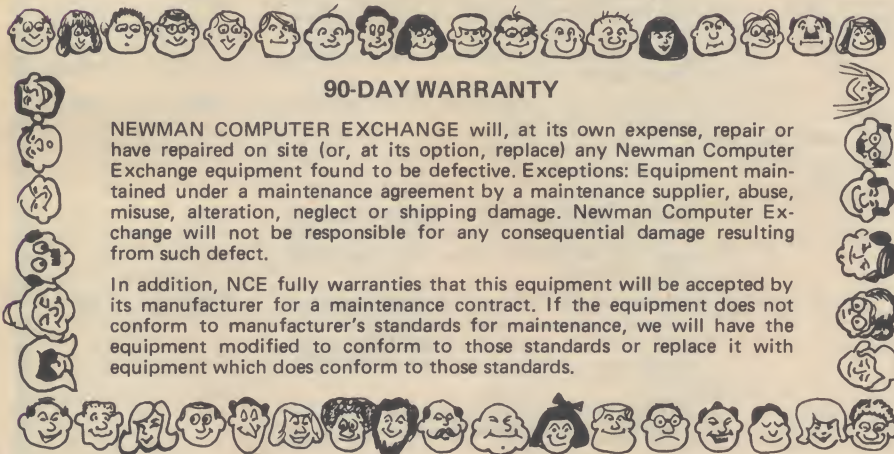
Printer & Interface to PDP11, 8/E, L, I or D.G. Nova.

165 C.P.S. 132 Print Positions. Adjustable sprocket feed. Vertical form feed.

\$2,550.00

index to savings

Books	33, 34, 35, 36, 37, 38, 39
Breadboards	45, 46, 47
Calculators	67
Computer other than DEC and DGC	2, 26, 28, 29
Cromemco	61, 62, 63
Data General and DCC	19, 21, 22, 23, 24, 25, 28
DEC LSI-11 and Peripherals	48, 49, 50, 51
DEC PDP-8 and Options	10, 11, 12, 16, 17, 18, 28
DEC PDP-11 and Options	11, 12, 15, 28
DEC other	11, 12, 13, 14, 15, 16
Digital Clocks	2
Equipment Rentals	9
Fairchild Kits	47
"Getting Started with Microcomputers"	52
Hazeltine	5, 6
IMSAI Computer and Peripherals	35, 42, 47, 53, 54, 55, 56, 57, 58, 59, 60
Interfaces	10, 21, 28, 44
KIM Computer and Peripherals	40, 41, 42
Latest Equipment Arrivals	6, 7, 8, 9
Magnetic Tape and Disks	6, 12, 13, 19, 22, 26, 29
North Star	42
Optical Page Reader	18
Paper Tape I/O	13, 26, 27, 34, 41
Polymorphic	65
Power Supplies	14
Printers and Interfaces	4, 6, 14, 20, 27, 29, 66
Punched Card I/O	14, 20, 26, 29
Supplies	32
TDL	64
Teletypes	4, 27
Terminals and Modems	4, 27, 28, 35, 66
Video Displays	4, 5, 21, 43, 44
Westinghouse Computers	29
Word Processing Equipment	30, 31



90-DAY WARRANTY

NEWMAN COMPUTER EXCHANGE will, at its own expense, repair or have repaired on site (or, at its option, replace) any Newman Computer Exchange equipment found to be defective. Exceptions: Equipment maintained under a maintenance agreement by a maintenance supplier, abuse, misuse, alteration, neglect or shipping damage. Newman Computer Exchange will not be responsible for any consequential damage resulting from such defect.

In addition, NCE fully warrants that this equipment will be accepted by its manufacturer for a maintenance contract. If the equipment does not conform to manufacturer's standards for maintenance, we will have the equipment modified to conform to those standards or replace it with equipment which does conform to those standards.

we buy

**ANY COMPUTER OR PERIPHERAL
ANY QUANTITY, ANYWHERE
WE ARRANGE ALL DETAILS
AND INSTANT CASH!**

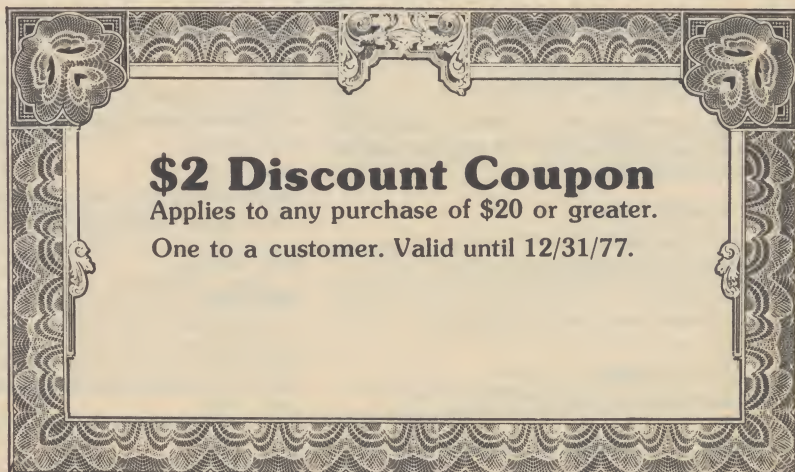
Call (313) 994-3200

"As is sale"

No warranty offered. Probably don't work, but at these prices they're worth it for the parts if nothing else.

Tinkerers delight

Dataflux 1/2 Megabyte Disks	\$ 90
Dataflux 1 Megabyte	\$135
Cipher 9 track Megabyte tape drivers	\$275
Cipher 7 track incremental tape drives	\$175



\$2 Discount Coupon

Applies to any purchase of \$20 or greater.

One to a customer. Valid until 12/31/77.

terminals

Buy with confidence from NCE

NEW AND USED TERMINALS FROM NEWMAN COMPUTER EXCHANGE

- 90 day warranty on all purchased terminals
- Available under rental and lease plans with generous purchase options
- Immediate delivery on most terminals (Call for delivery quotation)

Our stock of terminals is always changing. If you want something you don't see here, write or call. With our buying sources there is a good chance we will be getting what you need.

HARD COPY TERMINALS

	Purchase Price	Lease 36 Mo.
DEC LA36 Brand New! Cat. No. DEC-TRM-LA36.	\$ 1,950	\$ 65
Options:		
Acoustical Coupler, Cat. No. DEC-MOD-LA36C.	295	10
EIA/RS-232C Interface, Cat. No. DEC-IOX-LA36C. (For others, contact us.)	65	2
ASR 33 Teletype. 10 cps keyboard/printer, 8-channel paper tape reader/punch. Fully reconditioned. Cat. No. TTY-TRM-ASR33.	925	37
DEC LT33 DEC's version of the above with their modifications. Fully reconditioned. Cat. No. DEC-TRM-LT33.	950	38
ASR33 w/coupler A fully reconditioned ASR33 and an acoustical coupler. Cat. No. TTY-TRM-ASR33C.	1,120	45

SALE

ASR35 Heavy Duty Teletype 10 cps keyboard/printer, 8-channel paper tape reader/punch.	1,800	72
ASR 38 Same as ASR33 except 132 column full ASCII keyboard and graphics set, integral paper tape reader/punch. Sprocket feed.	1,200	48
KSR33 Same as ASR33 except without paper tape feature.	600	24
KSR33 w/coupler A fully reconditioned KSR33 and an acoustical coupler.	795	32

SOUND ENCLOSURES

DEC LA36 Gates cover, Cat. No. GAT-MIS-1M620 New!	449	18
Teletype 32-33 ASR, KSR, RO Gates cover with copy holder, Cat. No. GAT-MIS-3A130 New!	229	9
Centronics 101, 101A, 102 Gates cover with paper stacker. Cat. No. GAT-MIS-4C100. New!	329	13

CRT TERMINALS

NEW from Data General—a CRT Only \$1375—see p. 21 for details

Lear Siegler—a CRT KIT for a low \$875—see p. 35

Hazeltines—As low as \$795—see p. 5 for more details

580 from ADDS, BRAND NEW. The 580 displays a total of 1920 highly legible characters arranged in 24 lines with 80 characters per line. Communication with the data processing system or minicomputer takes place a character at a time on a conversational basis via a standard EIA RS232C interface or a 20 milliampere current loop interface. Transmission rates of 110, 300, 2400, or 9600 baud are available (switch selectively) on the 580's rear panel. Cat. No. ADD-TRM-580.	1,395	55
---	-------	----

Options for ADDS 520 and ADDS 580 Acoustical Coupler.

Cat. No. ADD-MOD-580C	300	12
EIA Cable Cat. No. ADD-CAB-580	50	2

Lear Siegler ADM-1 CRT, buffered, 64 character ASCII, half/full duplex, asynchronous. Edit feature, scroll mode. RS232C or 20mA current loop interface, Cat. No. LRS-TRM-ADM1.

TEC 1440, 24 lines by 80 characters, Cat. No. TEC-TRM-1440.	950	38
---	-----	----

COUPLERS

MULTI-TECH Systems FM300 acoustic coupler, Brand New, 110/300 baud, 0-450 bps, TTY & EIA interface, Cat. No. MTS-MOD-FM300.	400	16
Centronics 101 165 cps, 132 print positions. Adjustable sprocket feed. Vertical form feed with RS232C interface. Completely refurbished and repainted. Cat. No. CEN-PTR-101.	1,950	98
ODEC Printers to 300 lpm with RS232C interfaces, many models available. See inside cover.		

IBM Selectric Terminals with tape

- Remote and conversational terminals
- Power Typewriter
- Source Data Automation System
- Regular Selectric Office Typewriter
- Micro Computer Peripheral

Excellent working condition.
Made by Novar Corporation

All models include

- Selectric correspondence keyboard & type sphere
- Selectric printer, 15" carriage, 130 characters/line
- Built-in tape unit
- Self contained controller automates most functions
- Copy Holder
- Cartridge interchangeable with all models
- Digital cartridges-up to 73,000 character capacity each

Models Available

560

- Upper & lower case ASCII
- Transmission speeds of 10/30 or 15/30 cps
- Parity generation
- Built-in modem
- By the character & by the line editing capabilities
- Reverse Break & Interrupt feature

With Acoustic Coupler \$1,250

Without Coupler \$1,000

570

Same as 560 except uses Selectric correspondence code instead of ASCII

With Acoustic Coupler \$1,050

Without Acoustic Coupler \$ 800

512

A type & record only device. Prepares tapes that can be played back on the 560 or 570 modes. Also useful as micro computer peripheral.

ASCII Coded \$750 EBCDIC Coded \$600

Manuals (specify model desired for)

Operating Instructions	Cat. No. IBM-DOC-O	\$ 7.50
User Reference Manual	Cat. No. IBM-DOC-URM	7.50
Installation Guide	Cat. No. IBM-DOC-IG	10.00
Schematics & Service Guide	Cat. No. IBM-DOC-SSG	30.00
Extra cartridges (used)	Cat. No. IBM-DOC-UCAR	3.95

20% OFF on all supplies ordered with terminal. See p. 32

1A significant percentage of your rental payments can be applied towards the purchase price. Shorter term rentals avail.

Hazeltine peripherals

"The world's largest-selling typewriter-compatible video display"

NCE BARGAIN PRICES

Hazeltine 2000



- NCE price just \$1,395
- Hazeltine refurbished, Hazeltine & NCE warranties
- In stock for immediate delivery at catalog printing
- Not a "hobby" terminal, but the best commercial grade

H-2000 HAZELTINE VIDEO DISPLAY TERMINAL. Uppercase (64 ASCII alphanumeric and symbols); 32 ASCII control codes. All 128 ASCII codes can be keyed. 27 lines of 74 characters. Full cursor controls. Four editing keys: character and line insert and delete. 12 key numeric keypad. Two level video intensity with computer protect format feature. Protected "background" data may be held on screen while unprotected "foreground" data is transmitted and cleared. Computer direct cursor addressability. Tab function provides instant cursor advance—horizontally, vertically or diagonally in fixed format operation. Switch selectable full or half duplex or batch. EIA RS-232/C compatible. Switch selectable baud rates. Three standard selections available: (1) 110, 300, 1200, 2400, 9600, (2) 110, 150, 300, 600; 1200 and (3) 110, 1200, 2400, 4800, 9600. Switch selectable parity (odd, even, bit always one, bit always zero.) Accessories include Hazeltine Dual Magnetic Tape Cassette Unit and Hazeltine T-300 Impact Printer.

\$ 1,395

- for greater flexibility, the Hazeltine T-300 Impact printer and the Hazeltine Dual Tape Cassette Unit may be added to the Hazeltine 2000 Video display Terminal (see page 4).

More Hazeltine Video Display Terminals

H-1000 HAZELTINE VIDEO DISPLAY TERMINAL. Uppercase (64 ASCII alphanumeric and symbols); 32 ASCII control codes. 12 lines of 80 characters. No cursor controls. Two factory installed switch selectable baud rates. Available rates: 75, 110, 150, 200, 300, 600, 900, 1200, 1800, 2400, 4800, 9600. Note: 900 and 1800 baud are not available if either 110 or 200 baud are selected and vice versa. These must be specified when ordering terminal. Switch selectable half or full duplex. EIA RS-232/C compatible. Parity is switch selectable (even, odd, none.) Options available.

H-1200 HAZELTINE VIDEO DISPLAY TERMINAL. Same as H-1000, except 24 lines of 80 characters.

NCE
Price

~~\$ 835~~
\$ 795



~~\$ 1,250~~
\$ 1,195

latest equipment arrivals

CPU's • DISKS • TTY's PRINTERS • CRT's CARD and PAPER TAPE EQUIPMENT

We get hundreds of items each week. Here are those that missed our typesetting deadline. Our bargains go quickly so call if you are interested.

To insure that you get the first opportunity to buy our latest stock, ask to be on our mailing list. Fill out a form on the center-fold and you will receive all our latest listings.

<u>Model Number</u>	<u>Description</u>	<u>List Price</u>	<u>NCE Price</u>
11/45-BW	PDP11/45 Central Processor including: 32K words parity core TK11-C memory management LA36 DECwriter console Bootstrap Loader Real Time Clock EIS Cabinet	\$43,400	\$32,475
MF11-UR	32K parity Memory	8,800	6,875
TAll-AA	Dual cassette transport & control	4,200	2,550
RJP04-AA	Mega word disk pack drive & controller	36,750	31,900
RP04-AA	60 HZ single access	27,200	23,500
DQ11-DA	FDX/HDX NPR synchronous interface with programmable transmission speeds up to 10K band	3,570	3,000
DQ11-AB	Expander unit for DQ11-DA for LRC/CRC error detection	1,580	1,300
QJ580-AE	RSX-11D operating system & COMTEXT	6,050	3,025

Hazeltine (continued)

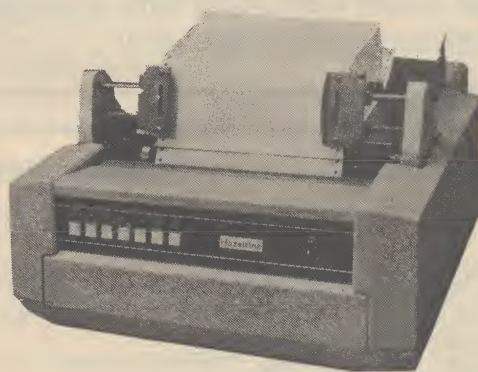
Options



HAZELTINE DUAL TAPE CASSETTE UNIT. Uses two Phillips 300-foot tape cassettes, 400 bits per inch. Approximately 125,000 characters can be stored on each side per cassette. Fixed at 2400 baud between terminal and tape cassette. Transmits on line at any baud rate selected by the terminal up to 1200 baud. Modes of operation: continuous, block, page, character, off-line, on-line.

\$ 1,095

Other Peripherals



HAZELTINE T-300 IMPACT PRINTER. 30 characters per second. 118 print positions. Ten characters per inch. Switch selectable single or double space (6 or 3 lines per inch respectively.) Upper/lower case (94 printable ASCII characters.) An original and six copies can be obtained for normal weight paper. Friction feed, paper roll 8½" wide. Options available.

\$ 1,950

Latest Listings, cont.

<u>Model Number</u>	<u>Description</u>	<u>List Price</u>	<u>NCE Price</u>
DQ11-BB	Expander unit for DQ11-DA for programmable character recognition (Bi-Sync Protocol)	\$ 1,090	\$ 800
DU11-DA	Synchronous line interface for auto dial back-up	1,500	1,100
DN11-AA	System unit mounting for auto dial unit	1,040	700
DN11-DA	Module set interface to Bell 801 ACU	1,280	1,000
DB11-A	UNIBUS repeater	1,540	1,200
DX11-BA	360/370 channel interface with 2848 emulator software package	20,220	8,000
DD11-B	Peripheral mounting unit	350	250
H960-DH	Expansion cabinet	3,630	3,000
LP11-VA	300 LPM Printer - 64 characters	11,800	8,000

Complete system - \$135,000
usual NCE 90 day warrantee

CIPHER MAGNETIC TAPE DRIVES

	<u>Original Price</u>	<u>NCE Price</u>
9 Track incremental model 70H		
Write Only	\$3,600	\$285
Read/Write	4,700	450

SAVE on Used DEC LSI-11 Equipment!

KD11-F CPU Board	\$800
MSV11-B 4K Memory	535

LATEST LISTINGS CONTINUED ON PAGE 9

WANT SOMETHING YOU CAN'T FIND?
WANT TO SELL SOMETHING?
WANT TO BE ON OUR MAILING LIST?
WANT TO ADD A FRIEND TO OUR MAILING LIST?
THEN CALL OR FILL OUT THE NCE ACTION REQUEST IN THE CENTERFOLD
NO ORDER IS NECESSARY

Remember! If it has a catalog number, you can send in an order without having to reserve first. Call for delivery and availability quotation.

REACH THOUSANDS OF BUYERS – CHEAP!

We've separated the buyers from the bystanders in this important, selective market.

Talk to the sharp shoppers who read and study this catalogue. Like you, they are looking for affordable answers to real problems, and thus are prime prospects for your business.

We're making profit from our catalogue responses and now we're offering to share our success with your (complementary) business.

You can now reach 100,000 people as hard to find as the bargains they read our catalogue for. Unless, of course, you buy into every other publication in the field. But then you still miss some and pay for a lot of unnecessary circulation.

Plus, you get the advantage of talking to these people while they are pricing and comparing products. We both come out ahead.

We're all business.

Our catalogue contains pages and pages of product offerings and advertisements. And we love to barter — for merchandise or ad space.

Send in your Camera-ready single-color artwork, Onetime rates:

- \$1200 full-page
- \$ 700 half-page
- \$ 400 quarter-page

Which of these services or products describe your business best?



- mini/computer service
- micro/computer service
- third-party service
- systems house
- consulting service
- wholesale
- equipment sales
- hardware products
- interface systems

If you checked off any of the above, then your ad in the NCE Catalog will reach the customer you want!

CALL (313) 994-3200 for Jan Geddes or drop us a note. We'll supply you with all the info you need to do business right along with us.

(We reserve the right to refuse any ad.)

RELIANCE ELECTRIC CO.

Computer Repair Center
6325 Busch Blvd.
Columbus, Ohio 43229
(614) 438-4570

MODULE REPAIR

DEC - 11/05, 11/35, 11/04 - LA36
Data General Nova 2's
GRI 99 - 909
Automate 31 - 32 - 33
Sub-Assembly Repair also available

FAST TURNAROUND

Modules are repaired within Ten (10) days of receipt.

MANUFACTURER SPEC

All repairs meet or exceed manufacturing specifications.

If you have a need for P.C. board repair or special device repair we can help you solve these problems.

For pricing or further information call or write us at the above address.

paid advertisement

Latest Listings, cont.

DEC Industrial Product Modules

Just arrived. Call for prices.

K522, M051, M060, M113, M206, M302, M501, M911, M962, M1103, M1307, M7300, M7301, M7304, M7306, M7307, M7310, M7312, M7318, M7319

See page 16 for a complete list of modules in stock. DEC power supplies are on page 14.

DIGITAL EQUIPMENT CORPORATION

	<u>List Price</u>	<u>NCE Price</u>
PDP11/45-CW 128K core, RF11-AA Disk Drives, (2) DB11 UNIBUS Repeaters, H960 Cabinet, August delivery.	\$176,832	\$125,000
PDP11/05-NC 4K		4,300
8K		5,000
16K	8,195	6,300
PDP11/10-AC 16K		6,450
32K		8,450
PDP11/15 4K		3,200
PDP11/20 4K	10,800	3,500
8K	13,800	4,500
12K		5,500
PDP11/40 8K		8,000
ME11-LA 8K		2,500
MF11-L Back plane & 8K core		2,000
A.E.D. Model 2500 Dual Floppy Disk and Controller to PDP11		2,700
TAll-AA Tape Cassette and Controller to PDP11	4,200	2,550
TU10/TM10 9 Track Mag Tape Drives and Controller to PDP10		7,500
TU10 9 Track Mag Tape Drive	10,300	6,200
TM10 Mag Tape Controller to PDP10		1,300
LA30 DECwriter		1,050
BM792-YB Bootstrap Loader	880	500
BM873-YA Bootstrap Loader	880	500

LATEST LISTINGS CONTINUED ON PAGE 10

rent or lease

Rent or Lease any mini, micro, terminal, peripheral or word processing system.

We don't care if the machine you want is in our catalog, to be purchased new from the manufacturer, or obtained from a competitor. All we ask is that the equipment be of the type we normally sell, cost a minimum of \$1,000, and that the lessee be credit-worthy.

If you are concerned about whether a computer system will work out, rent from us first and see. If you elect to buy, we will give you a substantial portion of your rental payments as a credit towards the purchase of the system.

Call for a quotation.

Latest Listings, cont.

For supplies, see page 32.

NEW DEC CABINETS

H960-CA 19" Cabinet Complete with Fan, Power Sequencer, Side Panels, Rear Door	750
H960-CA No Side Panels	700
H960 with Side Panels, Rear Door (No Fan, No Power Sequencer)	425
H960 Rack only (No Fan, Power, Panels or Door)	350
DEC DL11-E	\$ 600
RK05 with DEC Controller for PDP8/E	5,600

DATA GENERAL

	<u>List Price</u>	<u>NCE Price</u>
#4007/4008/4010 I/O Board, Real Time Clock and TTY Control	\$ 750	\$ 500
#8107 Hardware Multiply/Divide Board	1,600	1,200
#8108 Auto Program Load	400	300
#1012G Dual Bay Cabinet	1,900	1,000
D.G. #4030 Controller	4,000	3,000
#4035 Mag Tape Adapter, does not include cable		500
D.G. #6021 Mag Tape Drive (9 Track, 75IPS, 800 BPI) and Controller to D.G.	9,900	6,500

OTHER

Data Products 2310 Line Printer, 80 Columns, 64 Characters	4,500
---	-------

Last minute book arrivals
- from TAB

	Cat. No.	Price
The Compulotor Book	TAB-BUK-975	\$7.95
Microprocessor Programming for Computer Hobbyists	TAB-BUK-952	8.95
88 Practical OP Amp Circuits You Can Build	TAB-BUK-912	4.95
Build-it Book of Digital Electronic Timepieces	TAB-BUK-905	6.95
Display Electronics	TAB-BUK-861	5.95
The Complete Handbook of Slow-Scan TV	TAB-BUK-859	9.95
The Complete Handbook of Videocassette Recorders	TAB-BUK-811	5.95
Talk-Back TV: Two-Way Cable Television	TAB-BUK-773	5.95

(Book listings start on page 33.)

We want to buy!

Remember! If it has a catalog number, you can send in an order without having to reserve first. Call for delivery and availability quotation.

DEC minicomputer equipment

All equipment is Digital Equipment Corporation unless specified otherwise

CPU's

PDP8 4K computer.

List Price NCE Price

\$ 750



PDP8E 8K computer, programmer's Console, TTY interface and Omnibus with 20-quad bus slot, expandable to 40 slots with addition of BE8A omnibus expander. \$ 6,750 4,200

PDP8F 8K (with TTY interface). 6,000 3,200

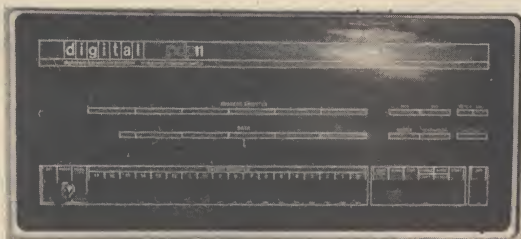
PDP8I 4K computer. 11,300 ~~795~~ ~~950~~

PDP8I 8K computer. --- ~~1600~~ 1,900

PDP8L 4K computer. 7,000 ~~795~~ ~~950~~

PDP8L 4K computer, TC08, 2 TU55s, Tele-type ASR33, and cabinet. 3,750

PDP8M 4K computer, programmer's Console, TTY interface and Omnibus with 20-quad bus slot. 6,000 4,000



PDP11/05 4K computer, 5 1/4" box. 6,295 3,500

PDP11/05 8K computer, 5 1/4" box. 6,295 4,300

PDP11/15 4K computer, 10 1/2" box, programmer's Console. 6,200 3,200

PDP11/20 4K computer, 10 1/2" box, programmer's Console, priority Interrupt, Power fail, TTY interface. 10,800 3,200

PDP11/40 8K computer. 7,500

PDP11/70 96K computer, RP06, TU16, CR11, LP11, etc. Call for details. New, still crated. Immediate availability. 184,000 184,000

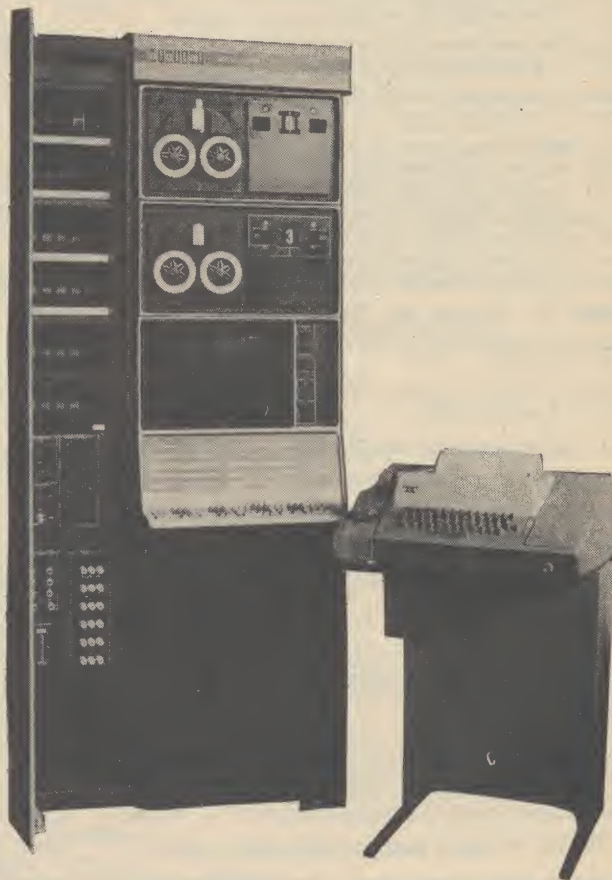
PDP11T34-BA 32K computer, 2 RK05-JA, LA36, octal Keypad. Brand new. 34,640 34,640

PDP11/45-CW 128K computer, RF11-AA disk drive, 2 RP03 disk drives, 2 DB11 Unibus repeaters, H960-DA cabinet. August delivery. 176,832 125,000

PDP12 8K computer, TTY, CRT, A/D, 2 DECtapes. 10,000

SPECIAL

PDP12 SYSTEM



only
\$10,000.00

- PDP12 CPU
- 2 TU55 DECtapes
- UR12 CRT
- ASR33 TTY
- A/D
- 8K core memory

*We have just a few of these systems available.
They are **READY-TO-GO!**
All interfaces included.*

DEC MINICOMPUTER EQUIPMENT

Memory

	List Price	NCE Price
MC8IA 4K expansion Memory for PDP8I or PDP12 computer. Expands 4K CPU to 8K.	\$ 4,000	\$ 1,200 700
MM8IA 4K expansion Memory for PDP8I or PDP12. Expands 8K CPU to 12K.	6,990	1,250 700
MM8IB 8K expansion Memory for PDP8I or PDP12. Expands 8K CPU to 16K.	12,500	2,500 1,400
MM8IE 4K expansion for PDP8I or PDP12. Expands 12K CPU to 16K.	5,000	1,000 700
BA08-MC8L Peripheral expansion unit and MC8L memory extension and control for PDP8L. Expands 4K PDP8L to 8K.	5,500	1,000 700
8K RAM add-in Memory for PDP8A, E, F, or M. Brand new, totally hardware and software compatible, single omnibus slot, one-year full warranty. Third party manufacture.		739
MM8EJ 8K Memory for PDP8E series.	2,750	1,400
MM11E 4K word Memory 1.2 ns for PDP11/15 or PDP11/20.	3,950	1,000
MM11F 4K word Memory 950 ms for PDP11/15 or PDP11/20.	4,550	1,000
ME11-LA 8K expansion for PDP11	5,200	2,500
MM11K 4K word Memory for PDP11.	2,700	350
MS11-JP 16K parity memory for PDP11/34	2,550	2,295
MM11LP 8K word parity core Memory.	3,630	2,750 1,600
Keronix 8K Memory for PDP11/05, 11/35, 11/40, 11/45		750
Keronix 16K Memory for PDP11/05 and 11/10.		1,500
Monolithic Systems Monostore 12K semiconductor Memory for all PDP11's except 11/70.		1,435
MM11L 8K word Memory for PDP11. New.	3,300	1,100
MM11S-4K 4K Memory & Chassis for PDP11.	3,000	760
MM11S-8K 8K Memory & Chasis for PDP11.	4,700	1,500
MA10 16K Memory Expansion for PDP10.	53,000	500 1,000

- AS IS -

We have recently done business with you very satisfactorily and looking forward to continue to do so.

Dynamic International Corp., Lajas, Puerto Rico

QUICK DELIVERY ON DL11 REPLACEMENT

DL11 Asynchronous interface replacements
New from independent manufacturer. Will do anything a DEC DL11-A, -B, -C, -D or -E will do via DIP switch. Does not include cable. \$600

DR11C replacement, from independent manufacturer 440

Disks

	List Price	NCE Price
DF32 32K Disk File & Controller for any negative level PDP8.	\$ 6,000	\$ 1,300
DS32 32K expansion Disk File. Must be used with DF32.	3,500	1,300
RF08/RS08 262K Disk File & Control for negative level PDP8.	15,000	4,500
RK01 Disk Drive.		2,500
Diablo 31 Disk Drive with System Industries Controller, Power supply and Interface to PDP8E.		5,500
RF11 262K Disk Controller for PDP11.	5,000	1,500
RF11, RS11 262K fixed head Disk and Controller for PDP11.	24,200	6,000
RK03 Disk Drive.		3,000
RK11/RK03 Disk Drive and Controller for PDP11.		6,000
RS08	18,150	4,000
RS64 & RC11 64K words Disk and Controller.		2,750
Systems Industries 3010 PDP11 Controller for Diablo series disks. (Power supply and chassis not included.)		500
Systems Industries 3210 PDP11 Controller for 16 sector Diablo series disks. Complete with power supply & chassis.	10,000	6,500
DF32-D positive logic 32K Disk.		1,800
DS32-D positive logic 32K Disk.		1,600
Wangco (RK05 substitute)		2,650

YOU ALWAYS NEED A SPARE DISK PACK!

We are offering
Used 12-sector

TYPE 2315 DISK CARTRIDGES

for **\$34.00** each

These cartridges work with:

RK03 RK05

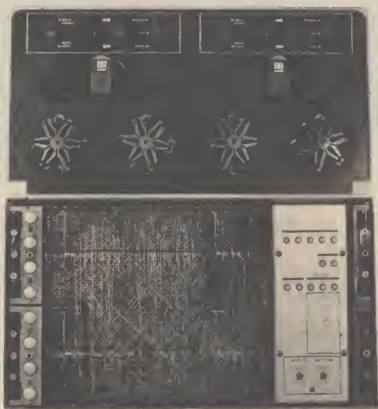
System Industries compatible disk
Wangco compatible disk

Order today! Specify Catalog No. SUP-HDK-2315
(Money back guarantee if these units do not work to your satisfaction.)

DEC MINICOMPUTER EQUIPMENT

Tapes

	List Price	NCE Price
TA11-AA Dual DECtape transport & control	\$ 4,200	\$ 2,550
TC01 DECtape Controller for negative level PDP8.	5,900	500
TC08A DECtape Controller for positive level PDP8.	5,900	2,500
TC08N DECtape controller for negative level PDP8.	5,900	500
TU55 DECtape Transport.	2,350	495
TU56 Dual DECtape Transport.	7,590	3,000
TD8E Dual DECtape Control & Transport.	8,000	4,000
TC11 DECtape Controller for PDP11.	5,000	3,000



TC11-GA Dual DECtape Transport & Control for PDP11.	14,490	6,000
TR02 with DEC 9-track Incremental Tape. Positive level.	---	1,500
TR05, TU68C PDP8E Controller and 9-track 800 bpi 45 ips Mag Tape Drive.	11,500	3,500
TR06F-7 Controller & 7-track Mag Tape for PDP11.	---	3,000
TU10 9-track Mag Tape & TM11 Controller. Power supply and cabinet included.	13,280	8,500
MR8EC 256 K ROM for TD8E.	990	725

SPECIAL SALE

DEC PDP8I DECtape SYSTEM with 4Kmemory,
TC08 controller and 2 TU55 \$3,750
DECtapes, Teletype, ASR33 and Cabinet
NCE's Minicomputer Answer to the Microcomputer

Call for items you don't see.

Paper Tape



Remex 5001 Paper Tape reader and interface for PDP11. 1000 cps, tape direction to right, 8 level swing bar, no take-up reel, 19" rack mount. \$ 1,500

PR8I	595
PC8I 300 cps Reader & 60 cps Punch.	\$ 3,900 595
PA60-A Punch Control.	300
PA61-A Reader Control.	300
PA68-F Interface.	300
PP67-B 6-level Punch (BRPE 18/BRPE B6).	300
PP68-A 6 or 8-level Punch.	300
PR68-A 6 or 8-level Reader.	200
PC08 Reader/Punch.	600
PC02 Controller for PC08.	800

... or interface it yourself

COMPLETE PAPER TAPE FACILITY

ROYTRON

See page 34

Buy
Paper tape equipment
Hard copy printers
or
Disks

and get a

**20%
DISCOUNT
ON
SUPPLIES**

Offer good only for supplies purchased at same time as corresponding peripheral.

See page 32 for complete listing of supplies.

DEC MINICOMPUTER EQUIPMENT

Line Printers

	List Price	NCE Price
LP11-FA 80 column, 64 character set and interface	\$12,000	\$ 4,000
LP11-JA 132 column, 64 character set and interface.	17,500	8,000



Centronix 101 165 CPS and interface to PDP8 or PDP11.

2,550



Data 100 2422 132 column, 64 character 125 LPM and interface to PDP8 or PDP11.

2,975

Data 100 2424 132 column, 64 character 300 LPM and interface to PDP8E or PDP11.

4,075

Power Supplies

	List Price	NCE Price
H710 Power supply for M-series (+5Vdc).	\$ 195	\$ 95
H721 Peripheral power supply (+5Vdc, -15Vdc, +10Vdc).	970	585
H722 PDP11 step-down transformer.	110	66
H783 Peripheral power supply (-15Vdc, +10Vdc).		150
H799 Peripheral power supply (-15Vdc, +10Vdc).		210

Card Readers

	List Price	NCE Price
CM8-FA 300 cpm Optical Mark Card Reader & Control for PDP8E.	\$ 6,900	\$ 3,200
CR8-FA 300 cpm Punch Card Reader & Control for PDP8E.	6,170	3,200



CR11 300 cpm Punch Card Reader & Control for PDP11.

6,170 3,200

CM11-FA 285 cpm Mark Sense Card Reader and Control for PDP11.

6,900 3,200

Interfaces

PDP11 and PDP8 Interfaces, BRAND NEW. From independent manufacturer. Fully software compatible, including all DOS, RSX & RSTS applications. Require one-quad slot in PDP11 chassis. Complete with 15 foot ribbon cable and connectors to printer.

	NCE Price
For centronics printer (or Printronix or Tally with Centronics buffer emulator) to any PDP11 or PDP8	
Cat. No. NCE-IOX-CENP11 for PDP11	\$ 650
Cat No. NCE-IOX-CENP8 for PDP8	650
For Data Products printer to any PDP11	
Cat. No. NCE-IOX-DPP11	1,250
For Data Printer printer to any PDP11 or PDP8	
Cat. No. NCE-IOX-DPRP11 for PDP11	1,250
Cat. No. NCE-IOX-PPRP8 for PDP8	1,250
For ODEC/Data 100 printer to any PDP11 or PDP8	
Cat. No. NCE-IOX-ODP11 for PDP11	675
Cat. No. NCE-IOX-ODP8 for PDP8	675
For Mohawk printer to any PDP11	
Cat. No. NCE-IOX-MDSP11	1,750

If you are in Ann Arbor, come see us. Our warehouse facility now includes a retail store featuring microcomputer systems and components for the home hobbyist, a complete line of related books and magazines, and, of course, used computers and terminals. We're sure you will enjoy browsing among the over 100,000 pounds of electronics on display!

DEC MINICOMPUTER EQUIPMENT

PDP 11 Options

	List Price	NCE Price
H960-CA Standard Cabinet 72" high. Includes fans, power distribution panel, extension feet.	\$ 935	\$ 700
KE11-A Extended Arithmetic Hardware Element, multiply, divide, multiple shift, normalizes, handles signed numbers.	2,310	1,260
KE11-B Extended arithmetic unit	1,820	1,450
KG11-A Communications arithmetic element for rapid calculation of cycle redundancy check (CRC) & longitudinal redundancy check (LRC). Used to calculate & list block check characters (BCC) required for synchronous communications.	1,150	650
KL11-A Teletype Control including address select & interrupt.	400	300
KW11-L Real time Clock line frequency. Interrupts each 16.6ms (60 Hz) or 20ms (50 Hz).	400	300
KW11-P Programmable real-time clock.	770	550
DL11 Individual asynchronous Interface.	----	600
DL11 REPLACEMENT Individual asynchronous Interface. NEW from independent manufacturer. Specify DL11-A, -B, -C, -D or -E.	----	600
DL11-W Replacement (not DEC). NEW.		650
DR11-A General purpose Interface.	----	300
DR11-C Replacement (not DEC). NEW.		440
DM11-AA A synchronous R6-line speed Multiplexor and mounting panel.	3,200	1,200
DB11-A Unibus Repeater.	1,540	1,000
AA11-D Digital to Analog Converter subsystem. 11 bits plus signal conversion, up to 4 channels available with an adjustable full scale output voltage of 0 to +10V ma. Space available for 4BA614.	1,300	650
BA614 Digital to Analog Converter. Mounts in AA11-D.	375	200
DA11-D DMA NPR channel transfer.		500
LT-33 KSR-33 hard copy terminal (without paper tape reader/punch).		950

The following are from an independent manufacturer.

Part Number	Description	NCE Price
General Purpose Interface Modules		
NCE-11B	Direct Memory Access Module with pins inserted for 12 IC positions for user's logic.	\$ 1,195
NCE-11C	General Purpose Interface Module with 16-bit input and 16-bit output registers and space for 20 user wire wrap positions. (Can replace DR11C.)	390
NCE-11C-01	Same as above with pins inserted for 20 IC positions.	420
NCE-11C-02	Same as above with pins and 14 and 16 pin sockets inserted for 20 IC positions. (Custom pinning for MSI/LSI available.)	440
NCE-DR11C	General Purpose Interface Module. (DR11C equivalent).	440
NCE-1710	General Purpose Interface Module with pins inserted for 40 IC positions for user's logic.	250
NCE-1710-01	General Purpose Interface Module with pins and sockets inserted for 40 IC positions for user's logic.	290
NCE-TA528	Digital I/O Module	615
NCE-11WWB	Wire Wrappable Module with pins inserted for 70 IC positions.	125
NCE-UT/930	Unibus Terminator	195
Peripheral Device Controllers		
NCE-LP11/Ls11	Line Printer Controller	1,250 /750
NCE-CR11	Card Reader Controller	875
NCE-11	Synchronous Serial Line Adapter	1,100
DT02-FA	2-way manual selectable Unibus Switch for PDP11.	1,000
DT02-FB	3-way manual selectable Unibus Switch for PDP11.	1,350
DP01-AA	Synchronous modem interface high & medium speed.	\$ 4,900 1,000
DC01-FA	8-line asynchronous Multiplexor for PDP11.	750

Need DEC Cables?

We have replacements

- Immediate Delivery
- Big Savings

- Money-back Guarantee
- Brand New

DEC Number	Description	NCE Cat. No.	NCE Price
BC05M	Cable connector for 20 NA. 2 ft.	NCE-CAB-BC05M2	\$30
BC05-C-25	Cable connector for EIA asynchronous. 25 ft.	NCE-CAB-BC05C5	\$85
BC08A-03	19-conductor flat mylar cable. M903 equivalent each end. 3 ft.	NCE-CAB-BC08A3	\$50
	Each additional foot	add	\$ 3
BC08-01	19-conductor flat mylar cable. Connectors M903/W031 equivalent. 1 ft.	NCE-CAB-BC08C1	\$50
	Each additional foot	add	\$ 3
BC08J06	40-conductor, 18 signals/alt gnds. Connectors H856/M953 equivalents. 6 ft.	NCE-CAB-BC08J6	\$70
	Each additional foot	add	\$ 3

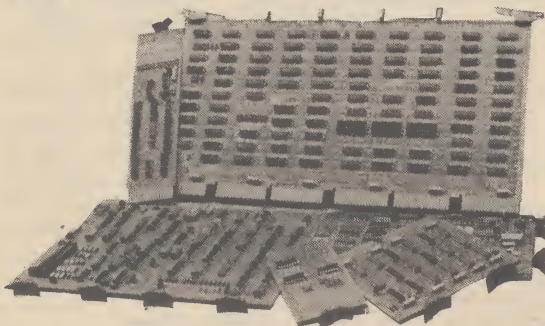
NCE is just starting to build replacement cables — if you have or anticipate a need for cables not listed here, let us know.

DEC MINICOMPUTER EQUIPMENT

PDP 8 Options

	List Price	NCE Price		List Price	NCE Price
H960-CA Standard Cabinet 72" high. Includes fans, power distribution panel, extension feet.	\$ 1,210	\$ 700	KA8E External Interface for positive I/O Devices.	500	350
DW08-A I/O Conversion Panel. Converts positive I/O Bus to a negative I/O bus.	2,900	900	KD8E Data Break Interface.	700	500
DM01 Data Channel Multiplexor (up to 7 high speed devices—negative bus.)	3,200	300	BE8A Omnibus expander. Additional 20-quad slot bus with M935 bus interconnecting set. Used for expanding the PDP8E or the BA8 expander box to 40-quad slots.	750	500
DM04 Data Channel Multiplexor (up to 3 high-speed devices—positive Bus.)	1,850	500	LT33 ASR 33 Reconditioned with MOD kit.	2,650	950
KD8L Data Break for PDP8L—High-speed access to Core memory (1 & 3 cycle).	630	145	KL8E Asynchronous Interface line unit.	450	350
KP8L PDP8L Powerfail detection & restart.	630	145	KL8-JA-TELCON replacement TK8. NEW. With cable.	610	575
KP8I Powerfail detection and restart.	630	145	LA-30 DECwriter hard copy terminal. Switch selectable to 110, 150 or 300 baud.		1,000
KE8I Automatic Multiply Divide.		1,250	LA-36 DECwriter II keyboard/printer. Asynchronous serial. <i>New!</i>		1,950
PT08B Asynchronous Serial Line Interface.		800	VT05 Alphanumeric CRT terminal. No parity. 64-character keyboard.		1,500
PT08C Asynchronous Serial Line Interface.		1,500			

Modules



- FULLY GUARANTEED
- IMMEDIATE SHIPMENT
All Modules in Stock Now
- ALSO AVAILABLE — Cables, Mounting Panels, Cabinets, DECTapes, Disk Cartridges
- WE WANT TO BUY — Modules and other components. All manufacturers' equipment needed.
- IF YOU WANT TO RECEIVE LATEST LISTINGS OF WHAT WE HAVE AVAILABLE, FILL OUT THE REPLY CARD ON THE CENTERFOLD.
- CALL (313) 994-3200 IF YOU NEED SOMETHING — OUR STOCK IS CONSTANTLY GROWING.

MODULE	DEC PRICE	NCE PRICE	MODULE	DEC PRICE	NCE PRICE	MODULE	DEC PRICE	NCE PRICE	MODULE	DEC PRICE	NCE PRICE
A124	74	45	R204	35	21	M002	13	8	M454	218	131
A601	65	39	R205	35	21	M040	39	23	M521	26	16
A812	250	150	R302	47	28	M101	24	14	M588*		
B171	19	11	R602	33	20	M103	45	27	M602	28	17
B200*			R604*			M111	22	13	M611	32	19
G008	123	74	S107	29	17	M112	18	11	M617	26	16
G208	70	42	S123	23	14	M113	18	11	M623*		
G296	45	27	S151	38	23	M113AA*			M624	45	27
G711	8	5	S111	18	11	M115	18	11	M700	94	57
G717	9	5	S202	28	17	M115AA*			M706	150	90
G723	21	13	203	33	20	M117	19	11	M709	210	160
G785	62	37	W002	18	11	M119	18	14	M715	263	158
G808	174	104	W005	21	11	M121	23	14	M734	56	34
G826	82	49	W026*			M141	29	17	M735	66	40
G908	135	81	W040	38	23	M160	33	20	M783	40	24
R001	9	5	W051	23	14	M161	35	21	M784	40	24
R002	9	5	W103	56	34	M169	33	20	M785	50	30
R107	25	15	W501	21	13	M202	20	12	M794	362	217
R111	16	10	W510	23	14	M203	26	16	M825YA	100	62
R113	23	14	W511	22	13	M204	25	15	M902	21	12
R123	22	18	W512	27	16	M206	30	18	M902YA	110	66
R131	34	21	W601	16	10	M207	33	20	M906	20	13
R141	16	10	W603*			M207 1	33	20	M901	17	10
R151	35	21	W640	45	27	M208	30	18	M907	23	14
R201	23	14	W701*			M211	69	41	M970	28	17
R202	27	16	W750	108	65	M220	152	91	M971	30	18
R203	30	18	W974	10	6	M233	55	33	M1307	20	12
			W990	7	4	M302	59	35	M1502		36
						M310	58	35	M1510*		
						M401	55	33	M7820	108	65
						M405	120	72	M7821	110	66

**NEED QUICK DELIVERY ON PDP-11
SYSTEMS?**

WE HAVE IT!

**the PDP11 compatible NCE11/X3
COMPUTER SYSTEM**



**COMPLETE FOR
\$5785**

The standard system includes:

- DEC LSI-11* CPU
- BOTH LSI-11* *double-sized* backplane and PDP11* UNIBUS* adapter port (can accommodate twice as many boards as the LSI-11*)
- real time clock (KW11-L or LTC compatibility)
- extended instruction set & floating point arithmetic
- 20K words of RAM (extended memory addressing to 512K)
- serial I/O module (DLV11 compatible)
- pseudo switch register

Directly replaces the LSI-11* or PDP11/03*

30 day warranty – parts and labor

*Trademark of Digital Equipment Corporation

... and now NCE offers the
NCE11/FDX3
MINICOMPUTER SYSTEM



A complete NCE11/X3 - based package including:

- central processor
- serial interface
- disk
- 10 formatted, certified diskettes
- operating system

*Ready to be connected to you TTY, CRT,
hard copy or graphics terminal . . .*

for only **\$11,995**

This system includes

- an NCE11/X3 microcomputer system • a dual drive, double density floppy disk with PDP11 DMA interface, 1.24M bytes of storage, expandable to 4 drives • DECRT11 Operating system with keyboard monitor, file utilities, text editor, MACRO assembler, FORTRAN IV compiler, linking loader.

Read typewritten pages directly into your computer with
DFR-200 OPTICAL PAGE READER (OCR)

- **NEW!**
- **90-day return-to-factory warranty**
- **Easily interfaced**
- **ASCII**

\$3,995

Cat. No. DTP-MIS-DFR200



The DFR-200 is the basic scanner which evolved from the extensive research program conducted by Datatype for development of an Optical Page Reader which would satisfy the stringent requirements in the graphic arts industry. The simplicity of design has made it possible to manufacture a highly compact, precisely engineered Reader offering all the salient features of the higher priced symbol reading devices. Utilizing IBM Selectric typewriters, equipped with the DF-2 print element, as keyboards for originating copy adds another dimension of reliability to the total input system for coupling with Video Display Terminals, Computers, or Phototypesetters.

The DFR-200 Reader is capable of keeping pace with the output of 10 to 12 productions typists. It has an effective processing rate of approximately 500 words per minute, with a reliable read-error rate of one error per 10,000 characters.

Data General equipment

CPU's



Nova with 8K bytes of memory

NCE Price

\$1,500↓

Nova with 16K bytes of memory

1,900↓

Nova 1200 with Automatic Program Load, Power Monitor & Auto-Restart. We also have a limited number of new units available. See additional Data General equipment listings.

Bytes Memory	List Price	NCE Used Price	NCE New Price
0K	N.A.	\$1,800	\$2,300
8K	\$ 5,100	1,975	2,550
16K	6,750	2,200	2,890
32K	8,350	2,800	4,165
64K	11,850	4,100	6,155

Nova 1200 Jumbo with Automatic Program Load, Power Monitor & Auto-Restart. We also have a limited number of units available. See additional Data General equipment listings.

Bytes Memory	List Price	NCE Used Price	NCE New Price
0K	N.A.	\$2,350	\$2,950
8K	\$ 6,750	2,525	3,200
16K	7,600	2,800	3,540
32K	9,200	3,550	4,180
64K	12,700	4,650	6,795

Nova 2, 3, and Eclipse DCC D-116 CPU Nova look-alike with Automatic Power Monitor Restart, Automatic Loader. Call for availability and pricing.

NCE Price

8K bytes \$2,050

32K bytes 3,600

DCC D-116 CPU with Automatic Power Monitor Restart and Automatic Loader

8K 2,550

32K 4,100

Memory

Nova memory

8K bytes \$3,650 \$ 500↓

Nova 1200, 1210, 1220 memory

8K bytes, used 500↓

16K bytes, used 2,000 1,300

32 K bytes, used 3,500 2,300

16K bytes, new 2,000 1,615

32K bytes, new 3,500 2,500

DCC memory for DG 1200 series computers

16K bytes 900↓

32K bytes 1,950

Plessey memory for DCC & DG 1200 series computers

16K bytes 900↓

Nova 800, 820 memory

16K bytes 3,200 1,600

↓ Indicates price reduction

Disks and Tapes

Decision 3170 disk controller and CDC 942th Hawk disk drive (10 MB) for Nova & DCC computers. (Not RDOS Compatible) \$4,900

Decision 3170 controller only, no drive. In box. 2,600

Dual Floppy disk drives, controller and cable for DCC or DG 2,550

Flex disk controller from DCC. Numbers 400920 & 400575. 900

Cartridge Disk Controller from DCC. Number 400575 1,750

DCC Magnetic Tape Controller Number 400990 for 1600 BPI Phase Encoded Tapes. Includes cable. \$2,250

DATA GENERAL TAPE SYSTEM

DG 4035 Magnetic tape adapter kit. Provides unit selection and adapts the Ampex TMZ, Wang 1175, Wang 1045, or PEC 6840 (9-track only) transports to tape control (4030). \$ 1,700 \$ 850

DCC Controller & Pertec 1600 BPI, 9-track, 45 IPS tape drive for DCC or DG. 4,900

Tri-Data 4196 Magtape System. 4 transports, 900 bpi, interface to Data General, includes electronics & power supply. 2 endless-loop Cartfile tapes per cartridge, Selectable 8, 12, or 16-bit words; 300,000 8-bit words can be recorded on an 150-foot tape formatted 100 words per record. Data transfer at 18,000 bits per second. Software & diagnostics to Nova computers included.

... I want to thank you very much for your response to our requirement and your efforts to fulfill this requirement. It is very much appreciated.

TURPIN SYSTEMS

SPECIAL SALE

DIABLO 21

Disk drive, controller for D.G. & DCC computers, power supply



NCE Price \$2,400.00

Remember if it has a catalog number, you can send in an order without having to reserve first. Call for delivery and availability quotation.

DATA GENERAL MINICOMPUTER EQUIPMENT

Printers

Also see pages 4,6,14, 27,29&66

Centronics 101 Serial matrix printer. Equivalent to DG 4034C that lists for \$4,500. 165 cps, 10 characters per inch, up to 132 characters per line. Character formation is with a 5 x 7 matrix. Completely refurbished and repainted. Included interface. \$5,000 value.

NCE
Price
\$ 2,450



ODEC

Refurbished. 64 character standard, 96 option, 132 columns.

Model	Speed (LPM)	OEM List Price	NCE Price
DESK TOP UNITS			
1422	125	\$4,144	\$2,500
1423	250	\$4,665	\$2,950
FLOOR MODELS			
2422	125	\$4,479	\$2,700
2423	250	\$5,000	\$3,100

WHISPER QUIET OPTION

Add \$300 to 14XX models. \$160 for 24XX models. Call for details.

NEW Data Printer Model V236 Printer & Controller
132 column, 64 characters, 200-600 LPM.

NCE
Price
\$ 6,950



Data Products Controller & 2310. A complete package for any Nova series computer. Utilizes Data Products 2310, 300 LPM, 64 character set, 80 columns. Software compatible. 5,200

Data Products Controller & 2410. A complete package for any Nova series computer. Utilizes Data Products 2410, 300 LPM, 64 characters, 132 columns. Software compatible. Equivalent to DG 4014, 4193, and 4034. 8,250

Litton Accounting Terminal & Controller. Can print on ledger cards. With keyboard. Split Platen capability. 1,200

DEC Line Printer Interface. Number 40925 700

Gould Data Systems Printer Controller. Number 11-5-05340-1. We don't have any information on these other than they worked with DCC computers. No warranty offered. 150

Printec 100 CPS Printer with controller and cable. 2,500

Card Readers & Controllers



Documation M200 Reads 285 80-column, EIA 12-row standard punch cards per minute. Demand feed. Hopper holds approximately 550 cards. Equivalent to DG 4016 card reader listing at \$2,900. Can be used with DG 4016 controller

NCE
Price
\$ 1,400

With Controller (Not from DG)

NCE
Price

Documation M300 Reads 300 80-columns, EIA 12-row standard punch cards per minute. Demand feed. Hopper holds approximately 1000 cards. Utilized by DGC. 2,250
~~1,600~~
1,500

With controller (Not from DG)

2,350 ~~2,450~~

Documation M600 Reads 600, 80-column, EIA 12-row standard punch cards per minute. Demand feed. Hopper holds approximately 1000 cards. Utilized by DGC. 2,200

With Controller (Not from DG)

3,100

DCC Card Reader/AD interface assembly Number 400955. 500

ASR33. Refurbished. 10 cps reader, punch, printer. Includes new Custom Systems 220 & 221 controller for ASR-33 Teletype. 1,200

Additional Data General equipment under latest listings on pages 6,7&9

DATA GENERAL MINICOMPUTER EQUIPMENT

Data General

	List Price	NCE Price
Data General I/O Assembly, TTY controller real time clock. DG Model numbers 4007, 4008, and 4010.	\$ 750	\$ 500
4065 and 4068 I/O subassembly and programmable interval timer.	500	800
8107 Multiply/Divide for any Nova 1200, 1210, 1220	1,600	1,100
4133 A/D subsystem, 16-channel differential input. Includes programmed I/O paddle-board and mating connector. Requires one slot Nova Mode Kit by General Digital Teletype modification kit. Includes all necessary cables. Converts model 33ASR to on-line control for use with 4010 control. NEW! Equivalent to DG 4009 that lists for \$200. Must specify model of Nova to run on.		95
4009 Teletype modification kit. Converts model 33ASR TZ, TC, TU, or TER to on-line operation for use with 4010 control. Works with any DG computer. UNUSED!	200	140
DCC I/O & TTY Controller. Number 400300.		250
DG I/O interface & asynchronous line controller. 4075 & 4077. Number 400915.	350	245
DCC General Purpose wire wrap board.		50
DG Extender board		150
DCC TTY & Real time clock board		140
DG Multiline Synchronous Interface	2,500	1,400
DG Single Line Synchronous Line Adapter Subsystem	1,200	825
DG Four line asynchronous multiplexor model 4063	1,500	900
Four line multiplexor (not DG). New.		1,250
Eight line multiplexor (not DG). New.		2,250

Interfaces

Nova/DCC116 Interfaces, BRAND NEW. From independent manufacturer. Fully software compatible. Require one slot in chassis. Complete with ribbon cable and mating connectors to printer.

For Centronics printer (or Printronix or Tally with Centronics buffer emulator) to any nova or DCC 116. Cat. No. NCE-IOX-CENDG. 750

For Data Products printer to any Nova or DCC116. Cat. No. NCD-IOX-DPDG. 1,250

For Data Printer printer to any Nova or DCC116. Cat. No. NCE-IOX-DPRDG. 1,250

For Odec/Data 100 printer to any Nova or DCC116. Cat. No. NCE-IOX-ODDG. 700

We also have spare DG boards, chassis, and power supplies.

NOVA EXPANSION CHASSIS

New From independent manufacturer

	NCE Price
NOVA EXPANSION CHASSIS P/N MDB-NEC-01	\$875.00
NOVA BUS TERMINATOR MODULE P/N MDB-NTM-01	125.00
POWER SUPPLY OPTIONS:	
P/N MDB-120-5 (12a 5v)	200.00
P/N MDB-250-5 (25a 5v)	357.00
P/N MDB-250-D-5/12 (12a 5v, 8a 12v)	350.00
P/N MDB-250-T-5/12 (12a 5v, 3.5/3.0 + 12-15, 3.5/3.0 - 12-15)	300.00

over-voltage protection and other voltages and combinations are available.

Prices include interconnecting cable.

Important Note: User must specify which model computer the expansion is to be connected to.

DATA GENERAL CRT'S in original box

new **\$1,375**

MODEL 6012 VIDEO TERMINAL

- 80 × 24 Flicker-free display
- Roll, page, page-buffered modes
- Edit Keyboard
- Half/full duplex
- 20 ma/60ma/EIA
- 110 through 4800 baud
- Use with D.G. Controllers 4010, 4023, 4060, 4100, 4255, 4256, 4257, 4258
- Fully software supported by D.G.

LIST \$2,700.00

Remember! If it has a catalog number, you can send in an order without having to reserve first. Call for delivery and availability quotation.

Data General and DCC Comp

- ALL NEW
- ONE YEAR GUARANTEE
- FROM

Magnetic Tape Controller for Data General and DCC Minicomputer

only \$2,500

Cat. No. 4-XIA00120-CUN

The Custom Systems Series 120 Controller Board has been designed to provide the necessary logic to interface with the Data General or Digital Computer Controls minicomputers. This controller board permits the end user or O.E.M. to add a full 9 track magnetic tape capability to his mini-computer system at a cost significantly below that of the minicomputer manufacturers.

This versatile controller board will accommodate up to eight tape units on the same system. Both phase encoded or NRZI or dual density tape units can be intermixed on a single controller board.

as a complete package consisting of:

- 15 inch x 15 inch printed circuit board to be installed within the computer chassis
- All required cabling

- Magnetic tape diagnostic program
- Installation instructions
- Full Documentation

Software Compatibility

Custom Systems magnetic tape controller is fully compatible with the instruction set for this device and the operating systems software supplied by Data General. As a result the magnetic tape driver included in the Real Time Disc Operating System will operate with the Series 120 controllers without modification.

Custom Systems also includes an extensive software diagnostic program which checks out both the magnetic tape controller and the magnetic tape drive in several modes of operation.

Multiple Device Wirewrap Board

The Custom Systems Series 240 multiple wirewrap board provides a low cost means of developing special interface controllers for Data General or equivalent Digital Computer Controls D-116 Minicomputers.

The board contains printed circuit wiring and two independent sets of logic for communicating with the minicomputer via the programmed I/O channel. In addition, over half of the board is available for mounting up to 104 additional integrated circuits used in the development of special interface logic.

The board is ideally suited to system configurations requiring several special controllers where minimizing the number of boards is a major consideration.

The Custom Systems Series 240 multiple wirewrap board measures 15 in. x 15 in. and is designed to fit within a Data General minicomputer. The board contains 2 one-hundred pin edge connectors which are compatible with Data General bus logic.

The wirewrap section of the board allows for use of 14, 16, 24 or 40 pin integrated circuits as well as discrete components. Space has been provided for up to one-hundred-four 14-pin integrated circuits, ninety-one 16-pin IC's, fifteen 24-pin, and nine 40-pin circuits or combinations thereof.

Board construction provides for a variety of external connectors. When the Series 240 board is used in any of the lower slots of a Data General or DCC minicomputer, the standard forty-eight interface lines available on each card slot may be used. If this board is placed on one of the upper slots where end plane wiring does not contain the memory bus lines, an additional 75 lines are available for a total of 123 external lines.

These lines may provide connections to a special device via the end-plane of Data General computers. Special connectors are also available through Custom Systems to facilitate connections via the card end of the Series 240 wirewrap board.

The Series 240 multiple device wirewrap development board contains two independent sets of logic for I/O data

bus buffering, I/O commands, device selection as well as BUSY, DONE, and Interrupt logic. The device selection logic permits the designer to select two allowable device codes through a set of jumpers. Selection of the device code responses to an interrupt acknowledge instruction is also provided by jumpers.

Each device code select line is combined with I/O command signals such as DATOA, DATIA, or START, so the resulting signals respond only for the selected device code. Two sets of I/O signals are brought up to wirewrap pins for use on the upper portion of the board. It should be noted that the basic logic can be easily modified to facilitate placement of three or four special peripheral controllers on the same board, thereby reducing the number of boards required.

Options

Wirewrap Pin Option 243. Option 243 provides wirewrap pins in each interconnection pad of the wirewrap section of the board.

Wirewrap Pin/Socket Option 244. Option 244 contains wirewrap pins in each logic interconnection pad as with option 243 but in addition includes ninety-one 16-pin low-profile sockets for dual in-line integrated circuits of the wirewrap section of the board. Other special combinations of 14 and 16-pin sockets are available upon request.

Protective Cover Option 245. Option 245 consists of a non-conductive protective cover which mounts on nylon standoffs above the wirewrap board. This cover is recommended to prevent accidental shorting between the wirewrap pins and the adjacent board in the computer as well as to provide physical protection for the wirewrap wiring.

MODEL

NO.	DESCRIPTION	CAT. NO	PRICE
240	Basic Board	4-XIK00240-CUN	\$450.00
243	Wirewrap pins	4-XIK00243-CUN	\$175.00
244	Wirewrap pins and sockets	4-XIK00244-CUN	\$260.00
245	Protective cover	4-XIK00245-CUN	\$ 25.00

Special Terms and Conditions For Custom System Equipment

Installation of Custom System Equipment Only

Installation of Custom System Equipment requires 30 minutes or less and is generally performed by the Purchaser. Detailed notes are included which illustrate the required steps for installing the controller board and cables. Installation can be provided by a representative from Custom Systems at a cost of \$150 plus expenses if a customer so requires.

Warranty on Custom System Equipment Only

All Custom Systems Equipment is warranted against defects in material or workmanship for a period of one year from date of shipment. Defective boards covered by this warranty shall be returned to Custom Systems prepaid. Upon Custom Systems' confirmation of defect, defective parts or boards shall be repaired or replaced and returned to the purchaser.

Service on Custom System Equipment Only

Service of Custom Systems' interfaces is provided at their facility. Boards returned to the factory are in most cases repaired and shipped within two days.

Service at a purchaser's facility is also available on a time and materials basis. Service of the interface by a Purchaser or by skilled personnel in the Purchaser's locale following the warranty period is facilitated by the complete package of documentation provided with each controller.

Delivery on Custom System Equipment

Delivery is generally 30 days. If faster delivery is required contact a salesperson at (313) 994-3200.

For supplies, see page 32.

atible Boards & Options

CUSTOM SYSTEMS

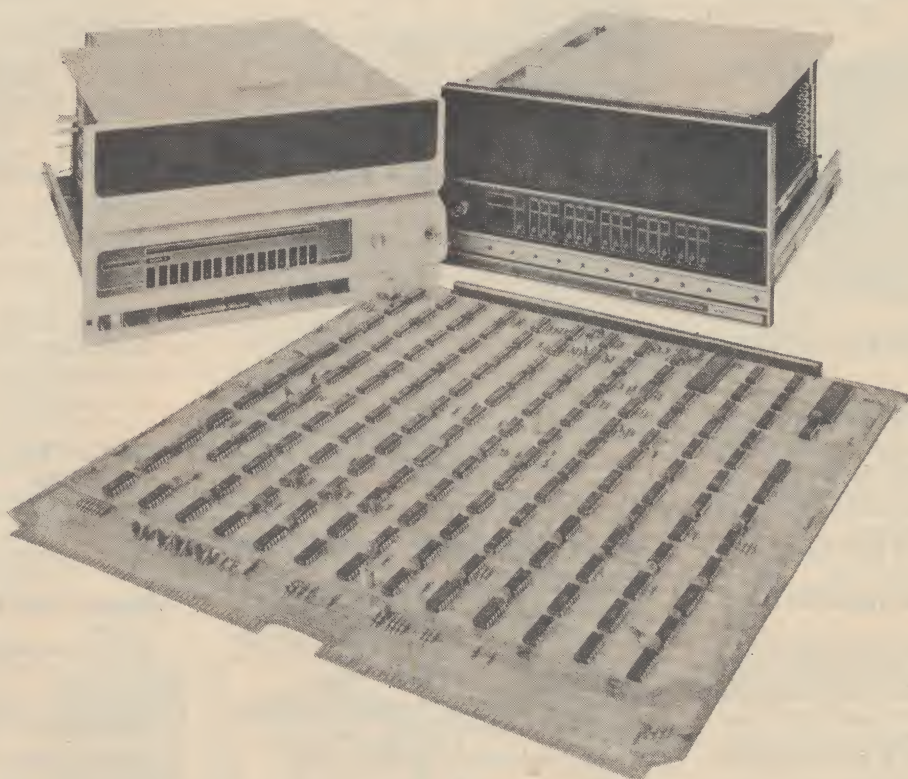
• SAVE UP TO 80%

The Slot Saver™ Multicontroller General I/O Board

• SAVE BACKPLANE SPACE

• ONE YEAR WARRANTY

• ALL NEW



The Custom Systems Saver™ General I/O board is a high density printed circuit board for the Data General or equivalent Digital Computer Controls minicomputers which contains interface controllers for the low-speed peripheral devices most commonly used with a minicomputer. Controllers included on this board are:

- Console terminal (Teletype or CRT)
- A second teletype or CRT asynchronous communications Interface
- Real Time Clock
- Paper Tape Reader
- Paper Tape Punch
- Line Printer (Centronics or Data Products)

The Slot Saver™, in addition to offering significant cost savings over similar controllers provided by the minicomputer manufacturers, will reduce the number of board slots taken up in your minicomputer. In many cases this will allow the end user or OEM customer to use a lower cost minicomputer with a smaller chassis or in larger systems can eliminate the need for an expensive expansion chassis.

The Slot Saver™ board logic for each of the interface controllers has been designed to offer flexibility in the selection of the manufacture and model of each type of peripheral device. Flexibility also exists on this board in the selection of the device codes for special system application. Specific details of each peripheral device should be noted at the time of the order.

All of these controllers are contained on a single fifteen inch board to be installed within the NOVA or Eclipse computer. Each controller is sold with all required cables, documentation and supporting software.

Software Compatibility

Custom Systems' Slot Saver board has been designed to be fully compatible with the instruction sets and the operating systems software supplied by Data General for each specific peripheral device. As a result the peripheral drivers included in the Assembler or Real Time Disc Operating System will operate with any of the controllers without modification.

Custom Systems also includes software diagnostic programs for the teletype (CRT), real time clock, paper tape reader, paper tape punch and line printer controllers which exercise these devices in several modes of operation.

Model 220 Basic Interface Sub-assembly

The board is sold as a general interface subassembly consisting of the 15 in. x 15 in. printed circuit board upon which the other controllers are mounted. This assembly also includes certain I/O command and data bus buffering logic common to all controllers on the board. Other device controllers such as the teletype or real time clock are options to this basic board.

REPLACEMENT FOR DATA GENERAL 4007 COSTING \$200. NCE PRICE \$150

Cat. No. 4-XIA00220-CUN

Model 221 Teletype Controller

This controller provides interface logic for a model 33ASR or KSR operating in a full duplex mode. The controller permits operation of a teletype using either BUSY/DONE or interrupt logic. This controller will access the paper tape reader on the teletype which has been suitably modified to allow this capability.

REPLACEMENT FOR DATA GENERAL 4010 COSTING \$150 NCE PRICE \$130

Cat. No. 4-XIA00221-CUN

Model 222 Low Speed Asynchronous Communications

This option when used in conjunction with the Teletype Controller provides an RS-232C compatible serial interface for the option of many CRT display terminals and line printers. Operation of a Bell 103 low speed asynchronous modem can be implemented using the Series 221 and 222 controllers. Please specify desired baud rate at the time of order.

REPLACEMENT FOR DATA GENERAL 4023 COSTING \$50 NCE PRICE \$40

Cat. No. 4-XIA00222-CUN

Model 223 Crystal Option

The Model 223 option for the Model 222 Low Speed Asynchronous communications feature provides a precision crystal controlled oscillator for selection of baud rates from 150 to 9600.

Cat. No. 4-XIA00223-CUN NCE PRICE \$40

DATA GENERAL MINICOMPUTER EQUIPMENT

Model 224 Full Asynchronous Modem Control

This option when used in conjunction with the Teletype Controller provides full modem control for a Bell Model 202 Data Set.

REPLACEMENT FOR DATA GENERAL 4029 COSTING \$200 **NCE PRICE \$140**
Cat. No. 4-XIA00224-CUN

Model 229 High-Speed Paper Tape Reader Controller

This controller will handle most popular brands of paper tape readers such as Remex, Iomec (Digitronics) and Tally. The controller will operate with 5, 6, or 8 level paper tape readers at speed up to 1000 characters per second. The interface includes all required cabling and controller circuitry. (Includes 10 foot cable. Additional cable lengths quoted separately)

REPLACEMENT FOR DATA GENERAL 4011 COSTING \$850 **NCE PRICE \$400**

Cat. No. 4-XRA00229-CUN **SAVE 53%**

Model 227 Second Teletype

This controller provides the interface logic for a second teletype in the same system. The controllers will come wired as device codes 50 and 51 unless a special device code is specified. Operation of the controller is identical to that for the Model 221 controller.

Cat. No. 4-XIA00227-CUN **NCE PRICE \$200**

Model 228 Second Variable Rate CRT Controller

This option contains the logic for the second teletype (Model 237) and an RS-232C compatible interface. Clocking of data can be controller either by an internal or external clock signal and must be specified at the time of order.

Cat. No. 4-XIA00228-CUN **NCE PRICE \$200**

Model 225 Programmable Real Time Clock

The Real Time Clock Controller provides four frequencies selectable under program control. These include 10Hz, 60Hz, 100Hz and 1000Hz. Frequency sources are the AC line for 60Hz and a crystal oscillator for the other frequencies. The controller operates using BUSY, DONE or interrupt logic.

REPLACEMENT FOR DATA GENERAL 4008 COSTING \$400 **NCE PRICE \$225**

Cat. No. 4-XOA00225-CUN **SAVE 44%**

Model 226 Variable Baud Rate CRT Controller

This option contains the Teletype logic (Model 231) and an RS-232C compatible interface (Model 232). The data transmission is, however, clocked from an external clock signal generated by the CRT display. This feature allows the controller to operate at whatever baud rate is selected by the operator on the controls of the CRT.

Accommodates most popular brands. Will work with CRT's with RS-232C interfaces. If your CRT doesn't come with an interface cable order one with this controller (Cat. No. 4-XIA00226-CUN **NCE PRICE \$35**)

Cat. No. 4-XIA00226-CUN **NCE PRICE \$150**

Model 230 Paper Tape Punch Controller

The controller operates with paper tape punches made by Remex, Iomec, or Tally. Ask for a special quotation on the controller for the Model B6 or B10 Burpe punches. The interface package includes required cabling and controller circuitry. Includes 10 foot cable.

REPLACEMENT FOR DATA GENERAL 4010 COSTING \$700 **NCE PRICE \$400.**

Cat. No. 4-XRA00230-CUN **SAVE 43%**

Model 232C Centronics Line Printer Controller

The controller operates with most models of line printers made by Centronics. The interface includes all required cabling (20 foot Standard, longer lengths available at extra cost).

REPLACEMENT FOR DATA GENERAL 1034 FEATURE COSTING \$1,400 **NCE PRICE \$475**

Cat. No. 4-XPA0232C-CUN **SAVE 66%**

Model 232D Data Products Printer Controller

Same as 232C except for Data Products printers.

REPLACEMENT FOR DATA GENERAL 4192 FEATURE COSTING \$1,400 **NCE PRICE \$650**

Cat. No. 4-XPA0232D-CUN **SAVE 54%**

12 channel VFU option for 232D

Cat. No. 4-XPA232D2-CUN **NCE PRICE \$75**

Model 232G Terminet 120, 300, 1200 Line Printer Controller

Same as 232C except for General Electric Terminals

Cat. No. 4-XPA0232G-CUN **NCE PRICE \$575**

Model 170T Centronics Printers Test Plug

Includes switch for single character lines and rotating character set

Cat. No. XPA0170T-CUN **NCE PRICE \$35**

Model 231 Reader/punch Controller

Combines Model 229 & Model 230 on one board. Includes cable.

REPLACEMENT FOR DATA GENERAL 4011 & 4012 COSTING \$1,550 **NCE PRICE \$750**

Cat. No. 4-XRA00231-CUN

IMMEDIATE DELIVERY on PDP-8 ASYNCHRONOUS I/O

replacement for DEC KL8-JA

Serial Data Format — I/O Code levels Switch selectable 5, 6, 7, 8
Stop bits Switch selectable 1, 1.5, 2
Parity Switch selectable odd, even, none

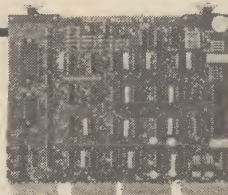
Interface Serial — I/O Teleprinter 20 MA current loop
EIA RS232C

Serial Data Rates Switch selectable 45.5, 50, 56.9, 66.7, 75, 110, 134.5, 150, 300, 600, 1050, 1200, 2400, 4800, 9600 Bits/SEC.

Modem Interface Program control or monitoring of: request to send, clear to send, data set ready, data term ready, data carrier detect, ring indicator.

Teletype Controls Program controlled reader relay driver.

Device Code Selection Any valid device code is switch selectable. Separate selection for input and output.



\$600

TK-8

Programming Uses instruction codes identical to the Digital Equipment Corp. KL8/E interface. The TL8/E may be used in systems using DEC software programs. Program modifications are required to take advantage of the Modem control and monitoring feature of the TL8/E.

Input Output Connector EIA standard connector with male pins in mounted on the PC board. Mating connector is Cannon DB25 S or equivalent.

Power Requirements (DC)

+5 Volts 1.0 Amps
-15 Volts 0.1 Amps
+15 Volts 0.05 Amps

Physical Single PC board occupies one slot in PDP8. Maximum of 17 TK-8 units per system. Use with PDP8/E, F, M family of minicomputers.

The TK-8 includes all of the functions provided by the KL8/E interface manufactured by DEC and is software compatible with the KL8/E, but also includes Modem control functions not available on the KL8/E.

DATA GENERAL MINICOMPUTER EQUIPMENT

The "Communicator"

Eight Channel Communications Multiplexer for Data General Minicomputers

The Custom Systems Series 260 Multiplexer Controller is a multiport communications interface for use with Data General, Digital Computer Controls or equivalent minicomputer. All necessary control logic to support up to eight channels is included on a single 15" by 15" printed circuit board which is inserted into the Data General minicomputer. A system expansion capability from a minimum of four lines to a maximum of sixty-four is also included.

The communications interface features eight separate input/output ports for connection to eight remote data terminals. Each remote terminal can have different data formats and baud rates which are selected with jumpers on the interface card. Baud rates can be from 110 to 19,200 Baud. Data formats can include even or odd parity, one or two stop bits and five to eight data bits.

MODEL NUMBER	DESCRIPTION	CAT. NO.	NCE PRICE
260-4	Four Channel multiplexer with individual baud rate & data format selection. RS-232 or current loop interface.	4-XIA02604-CUN	\$1250
260-8	Eight channel multiplexer on single controller board. Individual channel selectin of baud rate & data format. RS-232 or current loop interface.	4-XIA02608-CUN	\$1800
260-M	Full modem control circuitry on lower four channels.	4-XIA0260M-CUN	\$ 300
260-C	Cable Assembly.	4-XIA0260C-CUN	\$ 250

Each data channel is compatible with RS-232 type terminals. Current loop interfaces are also available and can be specified at the time an order is placed.

This board may be ordered either in a four channel configuration or an eight channel configuration. For systems with four terminals or less, the four channel model offers a cost savings.

An option is available which provides modem control including automatic answering. This option is required for those applications which include terminals which are remote from the computer site and communicate through a modem. Circuitry is included in this option to provide compatibility with the 103 data sets or the 201 data sets.

The Series 260 uses the existing Data General power supply and requires approximately 3 amps at +5 volts.

Cabling

Cabling for the Series 260 Multiplexer varies considerably with the model of Data General or Digital Computer Controls computer which you are using. Please review the attached price sheet for a description of the cabling options.

Software Compatibility

Custom Systems Series 260 Multiplexer board has been designed to be fully compatible with the instruction set and operating systems software which support the Data General 4060 multiplexer series.

Custom Systems also includes a software diagnostic program which will check out the multiplexer board in several modes of operation.

Installation

Installation of the controller and cables requires approximately 30 minutes and is generally performed by the Purchaser. Detailed instructions are included which illustrate the required steps for installation of the controller board and cables.

Installation can be provided by a representative from Custom Systems at a cost of \$150 plus travel expenses if the Purchaser so requires.

Data General Processor Options

Automatic Program Load Option

\$150

Consists of two special LSI ROM chips for the processor board. The option allows execution of a hardware bootstrap loader using the program load switch. Specify Nova 1200, Nova 2 or Nova 3 when ordering.

Equivalent to DG version costing \$400
Cat. No. 4-EIA08XX8-CUN

Power Failure/Auto Restart Option

\$50

The option consists of circuitry which you add to the processor board to permit automatic resumption of processing following a power failure.

Equivalent to DG Version costing \$400
Cat. No. 4-EIK08XX6-CUN

Sold in kit form with complete Installation Instructions

More Data General Equipment, page 28

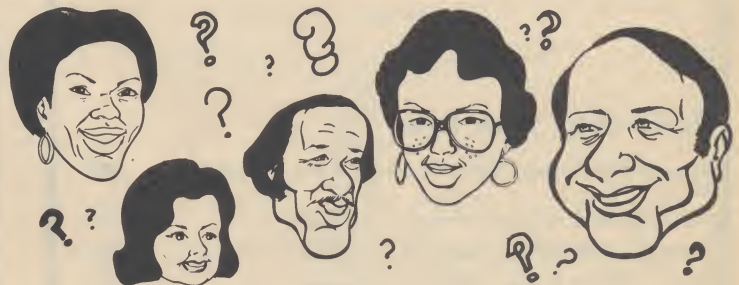
Extender Board for Data General

Extender Board

\$350

Special extender for DGC controller boards. Contains features not available on the DGC extender board such as extractor arms for the extender board and a slide mechanism which supports the extended controller board.

Cat. No. 4-XOA00350-CUN



Can we help you . . . Buy Something? Sell Something?

1. If you see something you want:

- If the item has a catalog number, just send in your order. See centerfold for ordering information.
- If the item does not have a catalog number, it is used equipment and you should call (313) 994-3200 to reserve your unit before ordering. Once reserved, send in order. See centerfold.

There is no obligation incurred by reserving equipment while obtaining funding approval.

- If the item does not have a price, call (313) 994-3200 and ask to speak to a salesperson who will be able to quote you current price and availability.

2. If you want something you don't see:

Call (313) 994-3200 and ask to speak to a salesperson. We may be able to obtain what you need or have it in stock and haven't had the opportunity to list it. You may also fill out a form on the centerfold indicating your requirement. We will call you if we have it.

3. If you want to sell something:

Call us or fill out a form on the centerfold indicating what it is you have to sell.

miscellaneous equipment

CPU's

	NCE Price
Burroughs B80 34-113 32K. See Page 2	\$20,000
Modcomp I 4K, unused.	1,995
Westinghouse 2550 See page 29	3,500

Disks

	NCE Price
Caelus 303/2 Disk Drive, 5 Mb.	1,350
IOMEC 2002 Disk Drive, 5 Mb.	2,750
CDC 9427 HR 10 Mb (Hawk).	3,900
Dataflux 1/4 Mb. and 1 Mb. disks. See page 3	
Diablo Model 21 with power supply.	1,750
Wangco N-2211	1,350

Mag. Tape

	NCE Price
Pertec 6840-9 Tape Drive, 9-track, 800 bpi.	875
Cipher Various models, incremental versions only. 7 & 9 track. See page	
Wangco Model 1025.	1,750

\$950 Mag Tape Sale

Wangco 812 9-track, 12.5 IPS, 8 1/2" reel, 800 bpi.	\$ 2,800	950
Kennedy 3112 9-track, 800 bpi. In cabinet.		950
Kennedy 3100 9-track, 800 bpi. In cabinet.		950
Pertec 2822-9 9-track, 800 bpi. In cabinet.		950
Tennecomp cassette TPI 351 Cartridge Tape Cassette		400

Paper Tape

	NCE Price
--	--------------

Paper Tape Sale

Superior Tape Readers Model TR125-1020, 125 cps, with power supply, dual spooling, unused. Cat. No. SPR-PTP-TR125.	\$ 325
--	--------



Facit Punch Model 4070, Table top version, self-contained with spooling, 8-level, 75 cps, unused. Cat. No. FAC-PTP-4070.	690
--	-----

Adtrol AR21 Photoelectric Paper Tape Reader 250 cps, 5 to 8 channel, bidirectional drive. Cat. No. ADT-PTP-AR21.	175
--	-----

Digitronics 507 Reader	295
Digitronics Punch Unused, unknown model.	295
Digitronics 2500 150-600 cps.	295
Facit 4022 300 cps, 6 to 8 level, unused.	500
BRPE Punch 8-level. Unused.	500

Hard Copy Devices

Data Printer V236 200-600 LPM. New! Sure to go fast at these prices.	2,750
Litton Model 30 Accounting printer.	650
Texas Instruments 751 Printer, as is. See page 16	150
Hazeltine T300 Impact Printer. See page 6	
Scope Data 200 Thermal Printer. 120 cps. Unused.	500
Data 100/ODEC Printers. 125-250 LPM. See sale on page 14	

Card Input/Output

CARD READER SALE

Documation M300	\$1,500
Reads 300 80-column, EIA 12-row standard punch cards per minute. Demand feed. Hopper holds approximately 1000 cards. Utilized by D G C & DEC. Sale priced.	
Hewlett-Packard 2761A	375
Mark Sense/Punched Card Reader, 300 cpm.	

	NCE Price
Documation M200 Reads 285, 80-column, EIA 12-row standard punch cards per minute. Demand feed. Hopper holds approx. 550 cards.	\$ 1,400
Documation M600 Reads 600, 80-column, EIA 12-row standard punch cards per minute. Demand feed. Hopper holds approx. 1000 cards. Utilized by both DGC & DEC.	2,200
Documation M1200 1200 cpm.	2,500
UNIVAC 1710 Interpreting Card Punch. 35 cpm interpreting card punch with keyboard. Interprets and prints characters by column while punching. Can be used off-line as a keyboard.	2,850

Hard Copy Devices (cont.)

CENTRONICS 101 SALE

	NCE Price
Centronics 101 Line Printer, Parallel input, 60 lpm, 5 x 7 dot matrix, 64 char. set, 132 col. adjustable sprocket feed, vertical form feed, completely refurbished, repainted, and up to current ECO levels.	\$ 1,750
101 with interface to DEC, DATA GENERAL or INTERDATA. Specify CPU Mfr. & Model.	2,350
Centronics 101 with RS232C Interface	1,950
Sound Controller for Centronics 101, 101A, 102. Brand New! Walnut finish.	279
Centronics 101A Same as 101 except with 7 x 9 dot matrix.	2,400
101A with interface to DEC, DATA GENERAL or INTERDATA. Specify CPU Mfr. & Model.	3,200



Control Data 9320* Line printer, 200 lpm, 132 columns, 64 char. set.	2,300
Data Products 2310* Line printer, 300 lpm, 64 char. set. 80 columns.	4,500
Data Products 2410* Line printer, 300 lpm, 64 char. set, 132 columns.	7,000



IBM "Selectric" 735 Heavy duty Input/Output writer, 10 or 12 pitch, fabric or carbon ribbon. Standard equipment provides 24 volt correspondence wired coils, common anode diode arc suppression, "energize to unlock," keyboard lock mechanism & wiring for "add bit parity." Pin feed platen.

Mohawk Data Sciences 4320 Line printer, 300 lpm, 64 char. set, 132 columns.	2,500
Mohawk Data Sciences 4330 Line printer, 300 lpm, 64 char. set, 132 columns.	2,500

sale!
~~\$1,500~~



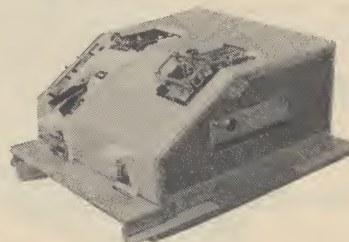
Teletype ASR33 10 cps Keyboard/printer, 10 cps 8-channel paper tape reader/punch. Reconditioned. Cat. No. TTY-TRM-ASR33 925

General Digital Teletype Modification Kit Converts to on-line operation. (Specify DEC or DATA GENERAL CPU Model.) Cat. No. GDI-IOX-TTY 95

The Best Value We Have Ever Offered

- 50 cps Reader/Punch
- Brand New!
- Original Cost \$1,800

Only \$295.



Manufactured by Roytron. The reader and punch share a common drive motor and housing, but are electrically independent. All signals are 48 volts for use with relays and contact switches. Logic can be copied from Roytron documentation to drive the reader and punch. 8 level. Complete with cover, tape supply reel and chad box. 13" X 6 5/8" and weighs 23 lbs. In original box.

Cat. No. ROY-PTP-8LRP

During Sale Giant Manual FREE! Can be ordered separately to evaluate unit. \$25.

Cat. No. ROY-DOC-8LRP

Etcetera

We have literally tons of cabinets, hardware, and cables. Call us with your requirements and let us give you a quote.

Do you sell minicomputer-based systems or terminals?

Now offer rental and lease plans to your customers and still get your cash up-front. We will buy from you and rent your equipment to your customer.

Contact us for details.

computer automation

**Get IMMEDIATE DELIVERY on
your 8K system for a LOW**

\$2,300

**HIGH PERFORMANCE
the ALPHA LSI-2/20G**



It includes:

- multiple stack handling
- hardware multiply/divide
- memory scan
- extensive byte capability
- priority interrupts
- Direct Memory Access
- power fail/restart
- programmer's console

Quantities Available

(TTY interface & chassis with power supply also included.)

CPU's

Alpha LSI 2/10G A 16-bit minicomputer system with TTY interface, basic variables, powerfail, programmer's console and chassis with power supply. No memory.

Alpha LSI 2/10G 4K

Alpha LSI 2/10G 8K

Alpha LSI 2/20G Includes all the items in the 2/10G system but features a more powerful CPU. No memory.

Alpha LSI 2/20G 4K

Alpha LSI 2/20G 8K

Alpha 16 16-bit minicomputer with the features of the LSI 2/10G system. Additionally, byte processing and addressing are included. Mounted in air-cooled chassis with power supply. No memory.

Alpha 16 4K

Alpha 16 8K

Jumbo Alpha 16 8K Same as Alpha 16 except 7 additional I/O slots.

List
Price

NCE
Price

\$ 1,400

\$ 2,985 1,850

3,355 2,075

1,600

3,310 2,050

3,705 2,300

900

1,200

1,500

1,900

Options

12505-01 Basic Variables board

\$ 95 \$ 60

12505-04 Real time clock, requires 12505-01 Basic Variables board

225 145

12505-16 EIA RS232C CRT interface, requires 12505-01 Basic Variables board

75 50

12505-32 Autoload, requires 12505-01 Basic Variables board

115 70

12505-02 Teletype (ASR-33) interface, requires 12505-01 Basic Variables board

100 65

22215-00 ASR-33 Teletype modification kit (new)

90 65

22215-01 ASR-33 Teletype cable

35 25

22205-00 Teletype. Modified ASR-33 with 16-foot cable. Includes remote reader control and motor on/off.

1,695 990

interfaces

We RENT computers.
page 9

Over the years we have built up sources for hard-to-find, low-cost interfaces. For your convenience we are now offering them to you. All are brand new. We try to keep the more popular interfaces in stock for immediate shipment.

10% DISCOUNT ON INTERFACES WHEN ORDERED WITH PERIPHERAL

Peripheral Processor	LSI-II	PDP-8 I/L	PDP-8 E/F/M	PDP-11	DG	Interdate	Varian 6201/7201	RS232
CENTRONICS Printers	\$450 NCE-IOX-CENLSI	\$650 NCE-IOX-CENP8I	\$650 NCE-IOX-CENP8E	\$650 NCE-IOX-CENP11	\$750 NCE-IOX-CENDG	\$750 NCE-IOX-CENIN	\$615 NCE-IOX-CENVr	\$275 NCE-IOX-CENRS
ODEC/DATA 100 Printers	\$450 NCE-IOX-ODCLSI	—	\$675 NCE-IOX-ODCP8E	\$675 NCE-IOX-ODCP11	\$700 NCE-IOX-ODDG	\$750 NCE-IOX-ODCIN	\$615 —	\$750 NCE-IOX-ODCRS
DATA PRODUCTS Printer	\$450 NCE-IOX-DPSLSI	—	\$1250 NCE-IOX-DPP8E	\$1250 NCE-IOX-DPP11	\$1250 NCE-IOX-DPDG	\$1250 NCE-IOX-DPSIN	—	\$850 NCE-IOX-DPCRS
DATA PRINTER Printer	—	\$1250 NCE-IOX-DPRP8	\$1250 NCE-IOX-DPRP8	\$1250 NCE-IOX-DPRP11	\$1250 NCE-IOX-DPRDG	—	—	—
MOHAWK	—	—	—	\$1750 NCE-IOX-MDSP11	—	—	—	—
DOCUMENTATION Printer	\$650 NCE-IOX-DOCLSI	—	\$1300 NCE-IOX-DOCP8E	\$1300 NCE-IOX-DOCP11	\$1050 NCE-IOX-DOCDG	—	—	\$1050 NCE-IOX-DOCRS

Westinghouse

2550 Satellite Processor



2550 Satellite Processor Supports synchronous communications to 9600 baud. Software package includes Communications Monitor, handlers for standard peripheral devices and an emulator which must be specified. Hardware includes basic processor with 8K 16-bit memory, power supply, memory parity, hardware bootstrap, real time clock, six card slots for I/O options, operator's communication console, work table and 52" RETMA cabinet and data set adapter for bisynchronous communications (EBCDIC with 16-bit CRC or ASCII with 8-bit LRC). The peripherals listed below may be added to the 2550, but, depending on the configuration, additional memory may be required. (WSTG No. 25SAT-02)

List Price	NCE Price
\$19,300	\$ 3,500

2550/2780 Emulator Package Software package which allows the 2550 system to emulate an IBM 2780. The 2550/2780 supports the following peripheral: card reader, line printer, and card punch. On a device substitution basis, it also supports magnetic tape, moving head disk, and paper tape reader. (WSTG No. 25SAT-20)

N/C	N/C
-----	-----

Miscellaneous

	List Price	NCE Price
4K Memory Expansion 4096 sixteen bit word (8,192 bytes) core memory module. (WSTG No. 25MEM-04)	\$ 3,000	\$ 1,200
Direct Memory Access Provides for direct access to memory on cycle steal basis for high speed peripherals. Transfer control logic is contained in each peripheral controller, only 1 DMA required per system. (WSTG No. 25DMA-00)	1,000	500
Moving Head Disk 40 million bits—double disk, including one removable and one fixed 20 million bit disk, controller, cabinet and power supply. (WSTG No. 25MHD-41)	13,750	4,500
Mag Tape Formatter Includes cable and Controller for up to four phase-encoded mag tape drives. (WSTG No. 25MTF-16)	6,000	2,400

Tape Drives Available for the 25MTF-16 Controller! Call us.

Expansion Systems Cabinet Used to expand the 2550 system. (WSTG No. 25CAB-53)	700	350
I/O Expansion Chassis Expansion chassis and power supply for I/O subsystem. Contains driver and space for up to 20 peripheral cards. Maximum of one per system. (WSTG No. 25EXI-20)	2,500	1,250

PLUS

Processor options, expander chassis, modules, cables, spares, and much more. Call for quotation.

I/O Peripherals

ASR-33 Teletype with Controller and cable. (WSTG No. 25ASR-33)

List Price	NCE Price
\$ 1,900	1,100

Line Printer 132 column, controller and cable. Prints 64 character set at 300 lpm (minimum) rate. Includes 12 channel vertical format unit, static eliminator and cabinet. (WSTG No. 25LPT-03)

15,500	2,700
--------	-------

Line Printer Same as 25LPT-03, except 700 lpm (minimum) rate. (25LPT-07)

25,000	9,900
--------	-------

Card Reader 300 cpm with 600 card hopper and stacker. Reads 80 column punched cards in extended Hollerith, 8-bit binary, or 12-bit binary format. Includes controller and cable. (WSTG No. 25CDR-36)

3,000	1,500
-------	-------

Card Reader Same as 25CDR-36 above, except heavy duty and with 1000 card hopper and stacker. (WSTG No. 25CDR-31)

4,025	2,025
-------	-------

Card Reader Like 25CDR-31, but 600 cpm. (WSTG No. 25CDR-61)

4,300	2,150
-------	-------

Interpreting Card Punch 35 cpm keyboard, controller and cable. Interprets and prints characters by column while punching. Keyboard permits off-line use as a keypunch. (WSTG No. 25CDP-37)

11,225	3,900
--------	-------

High Speed Card Punch 90 cpm (minimum) with 1000 card hopper and stacker. Punches and verifies 80 column cards in packed Hollerith or 12-bit binary formats. Includes controller and cable. (WSTG No. 25CDP-10)

15,000	7,500
--------	-------

Don't run out! Stock up on supplies for your TTY's and lineprinters. See page 32

NCE will, subject to outside manufacture schedules, attempt, but not guarantee, to have available to ship within 48 hours "standard stock items."

Super Sale on Word Processing Equipment

SPERRY UNIVAC

Rapid and convenient text editing, along with the usual stored paragraph playback capability, is the hallmark of the Mag Card machines. Using the standard magnetic card, the MC-200 in particular offers the same revision and duplication capability as the tape models. In addition, we offer mag cards and many convenience items



Dimensions (Console)	Height 32" Width 17" Depth 18"
Dimensions (Typewriter)	Height 7 3/4" Width 22" Depth 19 1/2"
Weight	Typewriter 54 lbs Console 86 lbs
Power Requirements	110V, 60Hz
Typewriter Model	745 Selectric
Automatic Typing Speed	180 wpm
Basic Storage Medium	Magnetic Card
Number of Storage Stations	MC200 2

Original List \$8,400

NCE Price \$2,295

NC200 (Mag, card, 2 stations)
Carbon Ribbon Cat. No. 6060-005
Fabric Ribbon Cat. No. 6060-136

MT200 (Mag, tape, 2 stations)
Carbon Ribbon Cat. No. 6065-005
Fabric Ribbon Cat. No. 6065-136

At these unbelievably low prices we are not offering our usual 90-day warranty. Instead, we are providing full service and training documentation.

You may receive our catalog on word processing equipment by filling out the action request in the center fold.

SINGLE SOURCE MAINTENANCE

SIRVESS OF CHICAGO INC.

34 N. CASS AVE.
WESTMONT, ILLINOIS 60559

In association with Sirvess Inc., the National Computer Maintenance Organization providing technical expertise in the installation, preventive maintenance and repair of minicomputers, computer systems and peripherals. We offer quick response for field service on a contract or time and material basis. We specialize in providing single source maintenance for multiple vendor systems.

For maintenance within the greater Chicago metropolitan area call:

SIRVESS OF CHICAGO INC.
312-963-4700

For maintenance elsewhere in the Nation call:

SIRVESS INC.
800-631-2078
201-843-6080

paid advertisement

supplies

Paper

For Teleprinters

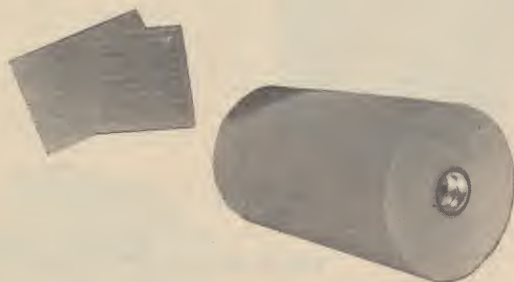
For Model ASR-33 & KSR-33 8-7/16 x 4-1/2" dia. canary std. 400 ft. friction feed, 12 rolls per carton, 72 column paper. Cat. No. SUP-PAP-TTYCAN

Single roll. (Specify)

NCE
Price

\$22.95

2.10



For 132 Column Printers & Terminals

14-7/8 x 11" white, fanfold, sprocket feed. 3000 sheets/carton. Good for all DEC, DGC, & HP 132-column line printers. Cat. No. SUP-PAP-132WHT.

37.95

Same as above only green-bar. Cat. No. SUP-PAP-132GRB.

37.95

Same as above only 3-part carbon interleaved, green-bar. 1000 sets/ctn. Cat. No. SUP-PAP-132.

43.95

For 80 Column Printers & Terminals

9-7/8 x 11" green-bar, fanfold, sprocket feed. 3000 sheets per carton. Good for all DEC, DGC & HP 80-column line printers & LA30 DECwriters.* Cat. No. SUP-PAP-080GRB.

26.95

For 72 Column DECwriters & Other 72 Column Terminals

8-1/2 x 11" white, fanfold, sprocket feed. 3000 sheets per carton. Cat. No. SUP-PAP-072WHT.

24.95

Same as above only 3-part, carbonless forms, white. 1150 sets/ctn. Cat. No. SUP-PAP-072WHT.

37.95

Paper Tape



8-Level

For All DEC & DGC High Speed Punches & Others with Fan Fold Hopper

1000 foot packs, 8-1/2" folds unoled, 1 inch. Printed top arrow. Warning last 15 ft. of each pack. 18 packs per carton. Gray. Cat. No. SUP-PTP-FFUGRY.

\$57.95

For All HP Punches, Teleprinters & Others Using Rolled Tape

8" roll contains 1000 ft. of oiled tape. Printed top arrow. 28 rolls/carton. Buff. Cat. No. SUP-PTP-ROOBUF.

33.50

Same as above only canary. Cat. No. SUP-PTP-ROOCAN.

39.95

6-Level

7/8" wide. 8" rolls. Printed top arrow. 32 rolls/carton. Gray. Cat. No. SUP-PTP-RGLCAN

15.95

Accessories

Paper tape patches. 1" wide vinyl. 100/box. Repair ripped tapes or splice tapes together.

Clear. Cat. No. SUP-PTP-PATCHC

9.75

Black. Cat. No. SUP-PTP-PATCHB

10.25

Ribbons and Ink Rolls

NCE
Price

For DECwriters LA30, LA36

1/2" x 40 yards. Nylon, black, each. Cat. No. 4-SRELA306-XXN.

\$ 3.95

Same—carton of 12. Cat. No. SUP-RIB-LA3036.

29.00

For DEC LS8, LS08, LS11, LS01, DGC 4034C, 4034D & Centronics Printers

1" x 36 yards. Nylon, black, each. Cat. No. SUP-RIB-CENT.

6.95

Same—carton of 12. Cat. No. SUP-RIB-CENC.

79.95

For DEC LE8, LP09, LP11, LP08, LP15 (80-column printers) & Data Products 2310.

9" x 28 yards. Nylon, black, each. Cat. No. SUP-RIB-DEC80.

26.95

For DEC LE8, LP09, LP10, LP11, LP12, LP15 (models F, H, J, K, R, S) (132 column printers) & Data Products 2410, 2420, 2440, 2470

14-1/2" x 20 yards. Nylon, black, each, with reversing bars. Cat. No. SUP-RIB-DEC132.

26.50

For Univac Serial Printers

Ink roll, Black, each Cat. No. SUP-RIB-UNI.

7.95

For Control Data 9322 Printers

2" x 36 yards. Black, each. Cat. No. SUP-RIB-CD9322.

14.50

For Mohawk Data Sciences 4330, 2144, 2446

3/4" x 150 yards. Black each. Cat. No. SUP-RIB-MDS.

14.50

For ODEC Printers

Film ribbons. Each. Cat. No. SUP-RIB-ODEC.

7.50

For Qume Printers (prices per dozen)

Fabric. Cat. No. 134.

1 Doz.

52.00

6 Doz.

44.00

Mylar Film Black. Cat. No. 149

1 Doz.

66.00

6 Doz. or more

49.50

Mylar Film Blue. Cat. No. 149U

1 Doz.

66.00

6 Doz. or more

49.50

For IBM I/O Writers (Selectrics) (prices per dozen specify quantity)

Carbon Film. Black. Cat. No. 005.

1 Doz.

10.50

6 Doz.

8.60

TELETYPE RIBBON SALE

For Teletypes Models 28, 33, 35, 37

1/2" x 12 yards. Black, single spool. Carton of 12. Cat. No. SUP-RIB-TTY.

12.50

Same except double spool. Cat. No. SUP-RIB-TTYDSP

17.50

Typewriter supplies available from our word processing catalog.

Magnetic Disks

Magnetic Disks

2315 Type

12-sector. New. Cat. No. SUP-DSK-12SCTN

\$67.50

12-sector. Used. Guaranteed. Cat. No. SUP-DSK-12SCTU

34.00

16-sector. New. Cat. No. SUP-DSK-16SCTN

67.50

Diskettes

Scotch 740. IBM compatible. Cat. No. SUP-DSK-3M740.

5.00

5-1/4" for North Star Drives. Cat. No. SUP-DSK-NSDSKT.

4.50

books

All books are paperback unless otherwise noted.

DIGITAL EQUIPMENT SERVICING GUIDE, By Robt. G. Middleton. With this book, technicians whose troubleshooting experience has been limited to linear electronic circuitry, such as radio and tv receivers, will be able to competently service digital equipment. It explains how switching works, how to evaluate symptoms of malfunction, and how to use test equipment. Numerous block diagrams, schematics, and photos.

Cat. No. SAM-BUK-21200 \$6.50

MOS DIGITAL IC'S, By George Flynn. Explains the basic construction, theory of operation, and circuit applications of metal-oxide semiconductors, the devices widely used in computer logic and similar applications. Discusses in detail the three main branches of MOS technology — CMOS, PMOS, and NMOS. Completely illustrated with circuits, block diagrams, logic truth tables, and diagrams of time sequences.

Cat. No. SAM-BUK-21299 \$5.95

TV TYPEWRITER COOKBOOK, By Don Lancaster. An in-depth coverage of tv typewriters (tv't's) — the only truly low-cost microcomputer and small-systems display interface. Covers tv't terminology, principles of operation, tv't configuration, graphics, memories, system design, cursor and update circuitry and techniques, hard copy, color graphics, and keyboards and encoders.

Cat. No. SAM-BUK-21313 \$9.95

RTL COOKBOOK, By Don Lancaster. Written with electronics experimenters, technicians, and engineers in mind. Explains the how and why of RTL (Resistor-Transistor Logic) and gives design information that can be put to practical use. Gives a multitude of digital applications ranging only from the basic switch to the sophisticated counter, and points out unexpected complications that may arise in the conversion of theory to practice. 240 pages; 5½ x 8½; softbound.

Cat. No. SAM-BUK-20715 \$5.50

FUNDAMENTALS OF DIGITAL COMPUTERS, By Donald D. Spencer. Gives readers a fundamental yet thorough exposure to digital computers. Explains the history, operation, types, and application of computers. Discusses programming, in detail, and three programming "languages" — FORTRAN, COBOL, and BASIC. Readers learn how to actually solve problems with a computer.

Cat. No. SAM-BUK-20729 hard \$6.95

ABC'S OF COMPUTERS (3rd Edition). By Lytel & Buckmaster. This basic reference for technicians and experimenters explains what computers are, how they operate, and what they can be expected to do. The most recent concepts in computer design, such as microelectronic circuits, laser memory, magnetic-domain storage, and voice input/output experiments, are discussed.

Cat. No. SAM-BUK-20851 \$4.50

SEMICONDUCTOR DIODE LASERS, By Campbell & Mims. A broad introduction to the injection laser. Gives an account of the early development of the laser, showing how the science progressed from ruby rods to gases and finally, through many refinements, to the semiconductor diode laser. Discusses construction methods of various manufacturers, circuits for pulsing the laser and detecting its output, conventional and infrared photographs, power requirements, power output, and practical uses.

Cat. No. SAM-BUK-20887 \$5.95

COMPUTER DICTIONARY (2nd Edition). By Sippl. Contains over 12,000 entries — including definitions, acronyms, and abbreviations. Catchwords for the first and last entries on each page are shown at the top of the page, and extensive cross-referencing is used. A must for teachers, scientists, computer personnel, engineers, students, and businessmen.

Cat. No. SAM-BUK-20943 \$8.95

COMPUTERS & PROGRAMMING GUIDE FOR ENGINEERS, By Donald D. Spencer. Written for the engineer or scientist. Explains what a computer is, how it works, and how it can be used to the best advantage. Discusses various types of digital computers, input/output devices, storage media, and covers the steps the engineer uses in solving problems on a computer. Details FORTRAN and BASIC programming. Includes several problem-oriented languages and languages for simulation problems.

Cat. No. SAM-BUK-20950 \$12.95

TTL COOKBOOK, By Donald Lancaster. A complete and detailed guide to transistor-transistor logic (TTL). Explains what TTL is, how it works, and how to use it. Discusses practical applications, such as a digital counter and display system, events counter, electronic stopwatch, digital voltmeter, and digital tachometer.

Cat. No. SAM-BUK-21035 \$8.95

USER'S GUIDE TO TTL, Wallchart. A gigantic 35" x 23" wall chart providing the essential information on transistor-transistor logic devices "at a glance."

Cat. No. SAM-BUK-21080 \$2.00

IC TIMER COOKBOOK, By Walter G. Jung. This book provides an excellent introduction to the field of IC timers and applications for anyone involved in modern solid state electronics. It contains many practical and useful circuits; it is also a valuable reference for basic theoretical material.

Cat. No. SAM-BUK-21416 \$7.95

50 IC PROJECTS YOU CAN BUILD, By Ronald Benrey. Includes an interesting selection of author-built and tested projects ranging from an IC crystal set, an intercom, a hi-fi stereo headphone amplifier, an auto tachometer, and a TV commercial killer. Each practical inexpensive project can be put together in a couple of evenings following instructions with a complete parts list. The book clearly states how ICs are constructed, how they work and how to work with them.

Cat. No. HAY-BUK-0723 \$5.45

HOW TO BUILD A WORKING DIGITAL COMPUTER, By Alcosser, Phillip, & Wolk. This book features a unique approach to explain how and why computers work. Complete construction techniques for building an inexpensive, working computer simulator are given in great detail. A fundamental explanation of programming is offered so that the computer can be utilized to solve simple problems.

Cat. No. HAY-BUK-0748 \$5.95

ELECTRONICS UNRAVELED - A New Common sense Approach. By James Kyle. For the first time ever, electronics is truly made simple. Author Kyle effortlessly and interestingly ties together tubes, transistors, and relays in an astoundingly clear exposition of their operational principles. No book on tube theory ever really applied to solid-state electronics... until now. Kyle starts his active-element discussion with a detailed description of the simple relay. By analogy, the concept is applied to transistors, vacuum tubes, and all other active devices. Includes ultra simple but useful projects.

Cat. No. TAB-BUK-691 \$4.95

DIGITAL ELECTRONICS: PRINCIPLES AND PRACTICE, By Brice Ward. Here is a read-and-do-it type lab/workbench handbook of practical basic theory and construction projects and experiments. The author develops gates, devises basic circuits, assembles counters, creates registers to permit addition and subtraction. Includes instructions on parts to use, how to wire up and operate, plus information on ready-to-assemble equipment and details for "building from scratch."

Cat. No. TAB-BUK-585 \$5.95

MODERN ELECTRONICS MATH, By J. & M. Clifford. This is the book that has it all — from the basic arithmetic of Ohm's law to differential and integral calculus. Math comes alive for you as concept after concept is applied to actual electronics problems. It leads you gradually to an understanding of basic arithmetic, the theory of numbers, AC and DC circuits, algebra, logarithms, and binary numbers. You are systematically prepared for even more advanced work: Boolean Algebra, construction and reading of graphs, scales, and nomograms etc.

Cat. No. TAB-BUK-655 \$9.95

INDUSTRIAL ELECTRONICS: PRINCIPLES AND PRACTICE, By Alfred Haas. A comprehensive text providing an in-depth treatment of modern industrial control processing and monitoring methods, including many of the innovations brought about by advances in solid-state electronics technology. You'll learn about the methods and devices used to automatically inspect, sort, and count, and about digital process control techniques.

Cat. No. TAB-BUK-583 \$8.95

BEGINNER'S GUIDE TO COMPUTER PROGRAMMING, By Brice Ward. A primer for learning computer programming from the ground up. Instead of attempting to explain programming in terms of language, the author pursues his subject from the viewpoint of program requirements. Instead of working backward from a language, the book begins by developing a simple programming language of its own, determines a need, then gives the instructions.

Cat. No. TAB-BUK-574 \$7.95

BEGINNER'S GUIDE TO COMPUTER LOGIC, By Gerald F. Stapleton. Without any prior knowledge you'll quickly grasp such seemingly complicated subjects as computer codes, digital logic operations and switching circuits. In easy-to-understand language the author explains decimal and binary-coded number systems and how they are used to add, subtract, multiply and divide, then basic logic functions and circuits.

Cat. No. TAB-BUK-548 \$4.95

See NCE's special hardware book package on page 37

SIMPLIFIED COMPUTER PROGRAMMING — Easy RPG Way. By Kelton Carson. This book really makes computer programming simple. The abbreviation RPG stands for Report Program Generator, a special language for communicating with computers. Rather than actually write out thousands of instructions for a computer, the programmer can use a "shorthand" language such as RPG to have the computer help prepare the program for him. All that is left for the programmer is to outline some very basic instructions on a few simple forms. The computer itself translates the simple "people" language of the forms to the complex "machine" language of the computer.

Cat. No. TAB-BUK-676 \$5.95

MODERN APPLICATIONS OF LINEAR IC'S, By United Tech. Pub. Each Chapter in this up-to-the-minute book represents the viewpoint of an engineering authority on the employment of an IC with which he is intimately familiar. The result is a wealth of new and exciting applications for off-the-shelf, low cost ICs. The types of linear ICs covered include amplifiers (four Chapters are concerned with op amps, three others deal with non-op-amp amplifiers), multipliers, comparators, phase-locked loop ICs, analog switches, voltage regulators, communication ICs, and consumer ICs.

Cat. No. TAB-BUK-708 \$9.95

More books—page 36.

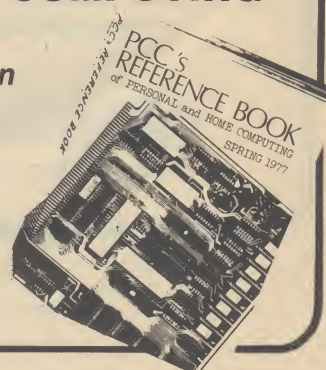
PCC'S REFERENCE BOOK OF PERSONAL AND HOME COMPUTING

The **FIRST** complete volume containing invaluable information including sources of

- equipment
- services
- software
- clubs
- magazines
- books

\$4.95

Cat. No. PCC-BUK-REF



**BRAND
NEW**
in original box

A COMPLETE PUNCHED TAPE UNIT!
Only \$295

THE ROYTRON 8-LEVEL READER/PUNCH

Usually \$1800-the best deal we have ever offered!

INCLUDES DOCUMENTATION!

This Paper Tape I/O unit is perfect for users who prefer to develop their own interface circuitry. The reader and punch share a common drive motor and housing but are electrically independent operating synchronously at 60 cps.

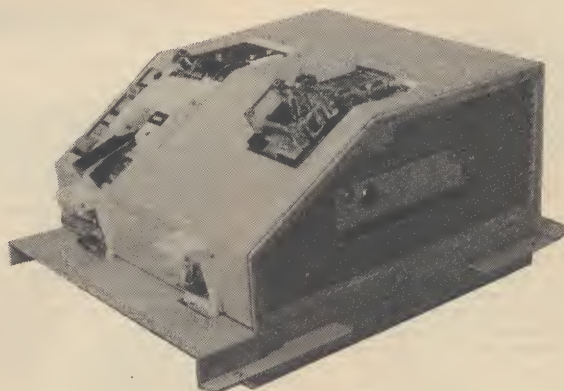
Standard features include tape tension switches and reverse feed on both reader and punch, tape feed switch on punch and semi-automatic tape loading on the reader.

All signals are 48 volts for use with relays and contact switches. Logic can be developed from the documentation to drive the reader and punch based on the following signal sequence:

Reader — Start search (moves tape)
Interrogate contacts (data)
Search complete (done)

Punch — Receive data
Start process (punch char.)
End process (done)

Size: 13 x 11 x 6½ inches Weight: 23 lbs.



• **Order direct.**
Specify Cat. No. ROY-PTP-8LRP **\$295**

- **Manual includes**
Schematic parts list,
theory of operation etc.
Cat. No. ROY-DOC-8LRP **\$25**

ROYTRON
SPECIAL

Discounts available to
Groups, Dealers & Clubs.
Please write NCE for infor-
mation.

Remember! Get a 20% discount on supplies purchased with reader/punch. See p. 32 for complete listing.

The one-two punch in microprocessors — Just published!

☐ MICROPROCESSOR BASICS

Edited by Michael S. Elphick

Here's the practical "how-to" information an engineer needs to evaluate and use specific microprocessors to the fullest! Unlike most books which either talk in general terms or only about a single microprocessor, this book provides detailed coverage of the popular models: 8080, 6800, F8, PACE, IMP, 2650, 1802, and 6100. Includes architecture, advantages and disadvantages, capabilities, and the very latest applications. **224 pages, paper, \$9.95.** Cat. No. HAY-BUK-5763

☐ MICROPROCESSORS: New Directions for Designers

Edited by Edward A. Torrero

This popular collection of articles from recent issues of Electronic Design magazine provides an exceptionally well-rounded view of the micro world. It presents practical information, data, and advice on selecting, using, and improving microprocessors. **144 pages, paper, \$10.95.**

Cat. No. HAY-BUK-5777



BOTH VOLUMES
\$19.95

Cat. No. PKG-BUK-HRD02

NEW ADDITION TO NCE'S IMSAI LINE

Introducing the IMSAI 8048 Single Board Control Computer

- complete programmable computer and hardware control system on an 8½" × 10" board.
- Just plug in the power source (a 5v p.s. or a 6v battery will do), connect the equipment you want to regulate, and you're up and running.
- Everything you need is there: CPU, RAM, 1K ROM/EROM, I/O, timer/counter, interrupts . . .
- IMSAI Control Computer is RS 232 compatible.
- There are 12 Quasi-bi directional I/O lines with handshaking, 14 more regular I/O lines, 5 heavy duty relays, Teletype and audio cassette interfaces.
- A 24-pad hexadecimal keyboard and 9-digit LED hex display.
- Extra 1K of RAM on board, sockets for another 1K of RAM and 2K of ROM/EROM. Also allows expansion of RAM off board.

***ROM computer**
\$249 kit

Cat. No. IMS-COM-RCOMK

\$299 assembled
Cat. No. IMS-COM-RCOMA

EROM computer
\$399 kit

Cat. No. IMS-COM-ECOMK

\$499 assembled
Cat. No. IMS-COM-ECOMA

5v Power Supply
Cat. No. IMS-PWR-PS5
\$99

***June delivery**

The Lear Siegler Dumb Terminal Kit



for only \$875

Cat. No. LRS-TRM-DTK kit

Escape the headaches of scavenged teletypes and jury-rigged TV sets. Not to mention all the frustrations of a hard day at the office. With a live and working video terminal that lets you get it all out of your system — or into it. Whether you've got your own micro, mini, or just a meaningful relationship with some remote mainframe.

All you need is a little initiative, and a few basic tools. The Dumb Terminal Kit gives you everything else. Including a handsome cabinet, CRT screen, keyboard, PC board, and all necessary electronic components. Plus illustrated, step-by-step assembly instructions and the terminal operator's manual.

Hook it up to your own micro or mini. Or with an acoustic coupler and a telephone call a remote computer right from your own garage, den or office. Why do it the hard way? Now you can do it the right way — your way!

Specifications

Display — 12" (diagonal)	600, 1200, 1800, 2400, 4800, 9600, 19200 baud (switch selectable).
Format — 1920 chars.; 24 lines of 80 chars.	Transmit/Receive Modes — Full & half-duplex (switch selectable).
Char. Set — 64 ASCII (upper case)	Word Structure — Total: 9, 10 or 11 bits.
Generation — 5 x 7 dot matrix	Data: 7 bits. Start: 1 bit. Stop: 1 or 2 bits.
Cursor — Moveable reverse image cursor	Parity: 1 bit (odd, even, high, low or none — switch selectable).
Interfaces — EIA standard RS232C & 20mA current loop (switch selectable)	Physical Char. — 13.5" x 15.5" wide x 19" deep; 25 lbs.
Auxiliary Interfaces — Extension RS232C port for interfacing serial asynchronous ASCII hard copy printer, magnetic tape recorder or additional data terminals.	Power — 70 watts at 115v
Communications Rates — 75, 110, 150, 300,	

They said: "You can always telephone . . . but you can't tell it much."

They were wrong!

Now with this book, you can customize your phone to your needs.

TELEPHONE ACCESSORIES YOU CAN BUILD

by Guilder

Remote telephone ringing, speech scrambler for privacy, automatic dialing, etc. are some of the useful phone accessories you can build for a small fraction of the commercial cost. Interesting uses for the home computer!



Cat. No. HAY-BUK-5748

**Just
\$3.95**

**And remember . . .
You can always dial NCE for bargains!**

Let me express again my appreciation for the courtesies extended to my family and me last week. Combined with a visit to the Henry Ford Museum the next day, the whole trip was both enjoyable and successful in its purpose.

Greenough Data Associates

books

(continued)

COMPUTER MATHEMATICS, By Conrad, Conrad, Higley. In this new text, the basic operations of arithmetic, logic, and array arithmetic are simplified into formal languages called the Numeric Calculus, Logic Calculus, and Array Calculus that can serve as a means for communicating with a computer much as languages such as FORTRAN and PL/1 do.

Cat. No. HAY-BUK-5095 cloth \$13.95

PROCESSOR ARCHITECTURE, By S. H. Lavington. Several fields overlap in processor architecture: digital electronics, memory systems, compiler writing, operating systems. In this new text, this common theme is pursued from first principle to a discussion of some of the advanced concepts of larger computer systems. Hardware and software design requirements are balanced together throughout the text, forming a useful reference for all concerned with computers.

Cat. NO. HAY-BUK-5457 \$8.95

OPAMPS

OP AMP CIRCUIT DESIGN & APPLICATIONS, By Joseph Carr. An easy-to-read, easy-to-understand, no-frills volume with ALL the applications info you need to put op amps right to work for you... you can design your own functional circuits as well as adapt the author's designs to your own requirements.

Cat. No. TAB-BUK-787 \$6.95

IC OP-AMP COOKBOOK, By Walter G. Jung. The first book of its kind to be published. Covers not only the basic theory of the IC op amp in great detail, but also includes over 250 practical circuit applications, liberally illustrated. Organized into three basic parts: introduction to the IC op amp and general considerations, practical circuit applications, and appendixes of manufacturers' reference material.

Cat. No. SAM-BUK-20969 \$12.95

PROGRAMMING PROVERBS, By Henry F. Ledgard.

Cat. No. HAY-BUK-5527 \$6.50

PROGRAMMING PROVERBS FOR FORTRAN PROGRAMMERS, By Henry F. Ledgard. Recently published, both of these books feature 26 ingenious proverbs designed to improve your programming accuracy and style. The first contains sample programs in PL/1, ALGOL, and several other languages; the second is specially designed to help FORTRAN programmers improve their skills.

Cat. No. HAY-BUK-5820 \$6.50

DIGITAL TROUBLESHOOTING: PRACTICAL DIGITAL THEORY AND TROUBLESHOOTING TIPS, By Richard E. Gasperini. New digital products are presenting as a big a challenge to service personnel as did the change from vacuum tubes to transistors. The thrust of this new handbook is practical digital theory and troubleshooting, so it is ideal for all engineers and technicians. It was originally developed as a training program for Hewlett-Packard and includes new test instruments that will replace or extend the oscilloscope in troubleshooting.

Cat. No. HAY-BUK-5708 \$9.95

COMPUTERS METHODS FOR SCIENCE AND ENGINEERING, By Robert L. LaFara. Scientists and engineers with computer skills are in demand these days. An excellent professional reference and text this volume offers the computer methods and techniques that scientists and engineers need to solve their numerical problems.

All derivations, proofs and methods are honed down to pertinent essentials without sacrificing accuracy or thoroughness. You'll find an exceptionally lucid, clear-cut treatment of problem organization and flow-charting.

The text offers basic background on computer hardware and computer organization, and assumes knowledge of FORTRAN or some other programming language.

Cat. No. HAY-BUK-5766 cloth \$14.90

COMPUTER CAREERS: PLANNING, PREREQUISITES, POTENTIAL, By Maniotes & Quasney. A practical guide for anyone now in, or about to enter, the computer field. It maps out the many career opportunities in the computer field (now and in the future), educational and training opportunities, valuable pointers on choosing the best computer school, and available ways to finance your education.

The book gives a concise, practical rundown of today's computer, its capabilities, functions, and uses. It offers both the newcomer and the experienced professional valuable

advice on problems and pitfalls, as well as opportunities and benefits. It will be invaluable to high school and college counselors, teachers, librarians, parents, and anyone considering a career in the computer field.

Cat. No. HAY-BUK-5913 \$5.95

COMPUTERS IN SOCIETY: THE WHEREAS, WHYS, AND HOWS OF COMPUTER USE, By Donald D. Spencer. Exploring the many ways computers are used in our society this book is appropriate as a supplement for courses in introductory computing and technology and as a text in courses introducing the social uses of computers. It examines a wide range of up-to-date applications in medicine, engineering, transportation, business the arts, education, law, process control, and many other areas.

Cat. No. HAY-BUK-5915 \$5.50

ASSEMBLY LANGUAGE BASIC: AN ANNOTATED PROGRAM BOOK, By Irving Allen Dodes. An invaluable aid for the beginning programmer, this book displays and thoroughly discusses 14 programs in Basic Assembler Language for the IBM 360/370 system. The programs, with handwritten annotations by the author, illustrate input-output, minor editing, edit and mark, binary multiplication and division, decimal arithmetic, the solution of a simple formula, the use of tape and disk for "scratch," address modification, and one method of sorting within core. The programs are arranged in order of increasing complexity, and the introductory remarks for each program tell its purpose and the new concept to be illustrated. Each instruction is thoroughly explained and illustrated in the Appendix.

Cat. No. HAY-BUK-5989 \$6.25

PATTERN RECOGNITION, By M. Bongard. Primarily for specialists in computers and artificial intelligence, this volume uses a non-mathematical approach and is of importance to engineers, physicists, psychologists, doctors, educators, philosophers — everyone attempting to understand such brain functions as the ability to find similarity, create abstract ideas, and act by intuition. The Soviet scientist clarifies the meaning of pattern recognition and problem solving.

Cat. No. HAY-BUK-9165 cloth \$14.90

ABC'S OF COMPUTER PROGRAMMING (2nd Edition), By Lytel & Buckmaster. Presents all the fundamentals of digital computer programming. Includes numbering systems, binary notation, punched card codes, arithmetic operations, octal numbering, the hexadecimal system, numbering codes, COBOL and FORTRAN.

Cat. No. SAM-BUK-20841 \$3.95

PERIODICALS

The only way to keep up with current mini/micro happenings!

Order
our
**NEWMAN'S
SAMPLER**
Byte Creative Computing
Interface Kilobaud
Personal Computing

**ALL 5 magazines for
\$8.00**

Cat. No. NCE-BUK-PER01

... also available:

The Best of BYTE, Volume I

If you are one of the unfortunates who missed the first few issues of **BYTE**, now is your chance to gain access to this valuable information. Edited by Carl Helmers Jr. and David Ahl, this volume contains material from the first 12 issues.

Cat. No. BYT-BUK-BEST1

Only \$11.95

ALPHA NUMERIC MUSIC WITH AMPLITUDE CONTROL, By Malcolm Wright. Program the Altair 8800 or any 8080 CPU chip with D/A (digital to analog converter) for playback for a complete 6-octave music system with tempo and duration.

Cat. No. PCC-BUK-MUSIC1 \$2.00

FINITE STATE FANTASIES, By Rich Didday. A delightfully clever "spoff" designed to both amaze and educate you, this collection of mind-teasing original cartoons is yet another example of Dr. Didday's ability to put programming on a human level.

Cat. No. MMM-BUK-460002 \$1.25

FUNDAMENTALS AND APPLICATIONS OF DIGITAL LOGIC CIRCUITS, By Sol Libes. Digital logic circuits are finding widespread applications in instrumentation, process control, even consumer products. If you have a basic knowledge of electronics, this book will supply you with all the information you need to get into the new era of digital electronics. You'll find everything from the basic theory to the most advanced applications — including the complete circuitry of calculators, digital voltmeters, frequency counters, as well as the latest computer applications. The book explores the applications of RTL, DTL, TTL, and other gating circuits. The presentation is simple and direct — neither math nor Boolean algebra is needed to understand these circuits and systems. Objective exam available.

Cat. No. HAY-BUK-5505 \$6.95

MINICOMPUTERS: STRUCTURE AND PROGRAMMING, By Lewis and Doerr. This introductory text on assembly language, machine architecture, and small machine algorithms is designed for use in computer science courses using small computers. It thoroughly introduces the reader to minihardware and then covers all the essentials needed to program a minicomputer. Section I (Preliminaries) covers number conversion, codes, and provides basic review. Section II (Minicomputing) includes an exceptional chapter on computer organization communications and peripheral devices, and goes on to define a minicomputer. The third section on Software Engineering covers the programming of the PDP-11 minicomputer and algorithms for small machines. Section IV on Microcomputing ends with a chapter on microprogramming.

Cat. No. HAY-BUK-5642 \$12.95

DIGITAL SIGNAL ANALYSIS, By Samuel D. Stearns. This important handbook features recent advances in the field, new design materials, and a comparison between continuous and digital systems.

Areas covered include sampled-data systems and analog-to-digital conversion; discrete and fast Fourier transforms; nonrecursive and recursive digital systems; simulation of continuous systems; digital filter analysis; and digital time series synthesis and analysis. There is also brand-new material on waveform reconstruction.

The appendices, especially valuable to the practicing engineer, include an extensive table of Laplace and z transforms, as well as useful FORTRAN routines for solving linear equations, computing the fast Fourier transform, and finding digital filter coefficients.

Cat. No. HAY-BUK-5828 cloth \$19.95

COMPUTERS IN ACTION, By Donald D. Spencer. This book, vividly illustrated with cartoons, photographs, and diagrams, offers the student and layman a greater understanding of computers and how they work. Its main objective is to answer such questions as "What are computers?" "How do computers work?" and "What can a computer do?" The book includes a discussion of how computers are used in our society and where the modern computer originated. After dealing with the components of a basic computer system, the book describes how computers are made to do the work of man. The BASIC programming language is used to illustrate the basics of computer programming.

Cat. No. HAY-BUK-5861 \$5.50

LARGE SCALE COMPUTER ARCHITECTURE: PARALLEL AND ASSOCIATIVE PROCESSORS, By Kenneth J. Thurber. Here is a complete survey of the entire field of the architecture of parallel and associative processors. It's a rare and comprehensive reference encompassing both general theory and practical coverage of the main systems currently in operation. The book relates associative and parallel processors to other architectures, provides detailed definitions, and then offers complete descriptions of ILLIAC IV, PEPE, STARAN and OMEN — their hardware, software, and configurations. This is the only single reference to cover all four of these important systems.

A special chapter discusses performance measurement techniques and their application to associative and parallel processors. The potential of these processors is explored along with discussions of how new circuitry advances may affect their architecture. Here's an ideal text for advanced courses in systems architecture.

Cat. No. HAY-BUK-5775 cloth \$18.95

COMPUTER PROGRAMMING HANDBOOK, By Peter Stark. A complete guide to computer programming and data processing, with scores of worked-out examples. An extremely comprehensive, informative, and interesting work on digital computer programming, and data processing in general. And it doesn't require a knowledge of higher mathematics to understand and use! This GIANT text covers all three types of computer languages machine, symbolic, and problem-oriented (which focuses on FORTRAN IV — the universal language): each type is covered in detail, complete with worked-out examples which include computer printouts and actual results. If ever there was a one-book course on computer programming, this is it!

Cat. No. TAB-BOOK-752 \$8.95

See the special programming-book package on page 39

CMOS

CMOS COMPANION, By Bob Lammert. CMOS (complementary metal-oxide semiconductor) has revolutionized digital logic family and gained widespread acceptance because of low cost and availability of hundreds of CMOS devices from several manufacturers. This book gives all information needed to make strong and true CMOS.

Cat. No. SAM-BOOK-21398 \$8.95

BIG CMOS WALLCHART '83

Cat. No. SAM-BOOK-21399 \$2.95

THE CMOS DIGITAL LOGIC PROJECT, By Merton. This volume handbook first outlines the operating characteristics of CMOS and then presents 110 CMOS digital IC circuits ranging in complexity from simple inverter gate and logic circuits to more complex electronic digital circuits. They are designed for interfacing and logic and memory design for the amateur and professional engineer.

Cat. No. HAY-BOOK-5156 \$4.95

UNDERSTANDING CMOS INTEGRATED CIRCUITS, By Meler & Garland. Takes a building-block approach to the subject of complementary metal-oxide semiconductor. Begins with basic digital ICs, then covers semiconductor physics, CMOS fabrication technology and design, and advanced CMOS applications.

Cat. No. SAM-BOOK-21122 \$4.95

ELECTRONIC CONVERSIONS, SYMBOLS & FORMULAS, By Rufus P. Turner. Here's a 3-in-1 answer book you'll use every day! Special easy-find thumb index puts any answer right at your fingertips. For everybody in electronics — technician, engineer, ham, experimenter hobbyist — this is the ideal no-nonsense handbook of useful formulas, symbols, and conversion (including metric). All you need is this book and an electronic calculator, and you're ready for any electronic problem whatsoever. You get all this in one handy, compact volume; a handbook containing hundreds of the most-needed electronics formulas; a complete dictionary of all the important electronics symbols; and a timely reference book of conversion factors that allows you to convert anything into anything!

Cat. No. TAB-BOOK-750 \$4.95

BASIC DIGITAL ELECTRONICS, — Understanding Number Systems, Boolean Algebra, & Logic Circuits. By Ray Ryan. An extremely easy-to-understand "self-learning" guidebook to digital circuits, logic applications, number codes and systems — and a sensible comparison of the various logic families. Provides the ideal foundation of digital logic knowledge on which you can readily build, for it covers everything from basic number systems to digital displays of every type. Includes a complete section on binary math; covers all types of logic from relay systems to advanced MOS circuitry, and features detailed descriptions of all the common digital circuits.

Cat. No. TAB-BOOK-728 \$4.95

See our hardware library special

MODERN GUIDE TO DIGITAL LOGIC - PROCESSORS, MEMORIES AND INTERFACES. By United Technical Publications. For the first time anywhere, the problem of interfacing high-speed logic with lower-speed logic and memory systems is taken up in depth. Emphasizing interfacing, this truly modern guide contains up-to-date data on the most advanced logic circuits used in today's digital systems — such as minicomputers and microprocessors. It's a veritable factbook of design info on Schottky TTL, high-speed ECL, high noise immunity logic, CMOS logic, microprocessors, and bipolar and MOS memory systems. Not only does the book fully discuss the basic logic families, but it fully illus-

trates how to design and interface logic and memory systems, using the latest techniques and digital ICs. Design factors of microprocessors, including programming time, are discussed in relation to overall system objectives.

Cat. No. TAB-BOOK-709 \$6.95

LINEAR IC APPLICATIONS HANDBOOK, By George B. Clayton. Here's a thoroughly thorough new guide that's just jam-packed with authoritative info on operational amplifiers, measurement amplifiers, active filters, waveform generators, monolithic IC modulators and demodulators, transconductance and variable gain amplifiers, four quadrant multipliers, timers, phase locked loops, and a great deal more.

Learn to use op amps in floating and differential amplifiers, bridge circuits, active filter circuits, and much more. Gain practical info on phase locked loops (PLLs) — their lock and capture range and governing parameters. Practical applications include demodulators for AM, FM, and PM, circuits for frequency synthesizers and translators.

Here is solid data on feedthrough and offset problems, DC errors and nonlinearities of four quadrant linear multipliers. There are complete details, too, on the construction of all kinds of timing circuits. Anyone who wants practical data showing how linear ICs work, and down-to-earth data on how to use them in solving real-world problems, just can't go wrong with this new guidebook.

Cat. No. TAB-BOOK-938 \$6.95

BUILD YOUR OWN WORKING ROBOT, By David Heiserman. Here are complete instructions — plans, schematics, logic circuits, and wiring diagrams — for building Buster, the most lovable (and mischievous) mechanical pet in the world! He'll forage for his own "food" and scream when he can't find it. His "curiosity" will get him into one plight after another, but Buster has the capacity to get himself out of trouble just as easily as he got into it! Not a project for novices, Buster is a sophisticated experiment in cybernetics. You build him in phases, and watch his personality develop as you add progressively more advanced circuitry to his mainframe. The first phase robot, Buster I, is "leash-led" and dependent on his master for decision-making; you create the "animal" and give him wheels, steering capability, and the capacity to "understand" your basic commands. Phase II makes Buster more independent. Now he has a basic brain he can use to decide when he's "hungry" (in need of a battery charge), or trapped into a physically binding situation he can't get out of. Properly equipped with a wireless mike and a simple receiver, he can enter a room and talk with the occupants... or scout around the floor, chase the cat, or perform ballet maneuvers. Buster III usually responds when called (not always, though — he's as unpredictable as a chimp). You can take him for walks and laugh as he inspects your neighbors' driveways or follows children down the block. When he gets "hungry" he searches until he finds his charger; and when he does find it, he plugs himself in and settles down for his feeding. You'll love Buster. And you'll enjoy watching his personality evolve as you build him from the ground up. You'll find the learning experience totally unparalleled in electronic construction.

Cat. No. TAB-BOOK-841 \$6.95

HARDWARE LIBRARY SPECIAL

Basic Digital Electronics (pg. 37)

Beginner's Guide to Computer Logic (pg. 33)

Master Handbook of 1001 Practical Electronic Circuits (pg.39)

ALL 3 BOOKS for just \$17.85 (10% off list!)

Order Cat. No. PKG-BOOK-HRD01

Wild GAMES Sanctuary

WHAT TO DO AFTER YOU HIT RETURN, or P.C.C.'S First Book of Computer Games. By PCC and HP. This book provides a starting point for exploring the uses of computers in the capacity of playmate, tool, and teacher. The computer games and simulations were contributed by a variety of people. It is crammed to the margins with interesting tidbits and graphics — one of those books you feel compelled to pick up, just to see what is inside.

Cat. No. PCC-BOOK-WTD \$6.95



101 BASIC COMPUTER GAMES, Edited by David H. Ahl. Digital's 101 Basic Computer Games is not the first collection of computer games and simulations nor will it by any means be the last. However, in many ways it is unique. It is the first collection of games all in BASIC. It is also the only collection containing both a complete listing and a sample run of each game along with a descriptive write-up.

Cat. No. CRC-BOOK-101GAM \$7.50

GAME PLAYING WITH COMPUTERS, revised Second Edition. By Donald D. Spencer. Now you can sharpen programming skills through a relaxed and radically different approach. Completely devoted to computerized game playing, this volume presents over 70 games, puzzles, and mathematical recreations for a digital computer. It's fully illustrated and includes more than 25 game-playing programs in FORTRAN or BASIC, complete with descriptions, flowcharts, and output.

Cat. No. HAY-BOOK-5103 cloth \$16.95

DIGITAL/LOGIC ELECTRONICS HANDBOOK, By Wm. Hunter. Learn digital electronic, number systems, logic and Boolean algebra while studying modern digital circuits for a clock, calculator, thermometer, multimeter, and interval timer in this down-to-earth book on logic and digital electronics... without the mass of formulas and equations found in many books, but with practical info. You are led step by step through the very basics of logic — from the invention of number systems to their modern applications in everyday events, and how logic is applied to addition, subtraction, multiplication, and division. It's all here — basic digital circuitry, logic symbols and their meanings, integrated-circuit logic devices, and digital light-emitting diode circuits.

Cat. No. TAB-BOOK-774 \$6.95

PRACTICAL SOLID-STATE DC POWER SUPPLIES, By T. D. Towers. This is a circuits book — a "hands-on" construction book — a book that is above all practical. Here's a powerhouse of over 150 illustrations, and over 200 power supply circuits and variations. It includes detailed instructions — schematics, parts lists, etc. — for designing and building all types of power supplies. Best of all, one needn't know all that much about electronics to use this intriguing volume, for it covers what theory is needed in simple terms anyone can understand.

Cat. No. TAB-BOOK-891 \$6.95

PROGRAMMABLE CALCULATORS, By Charles Sippl. Written at an easily understandable level, this pragmatic "how to use what's available" book offers a 16-page glossary of terms as well as an appendix of clearly defined capabilities of products presently on the market. In addition to being a tutorial book, it is also a guide to the calculator industry.

Cat. No. MMM-BOOK-460088 \$14.95

OPTOELECTRONICS GUIDEBOOK-WITH TESTED PROJECTS, By R. W. Fox. A fact-filled introduction to the fascinating world of optoelectronics (liquid crystals, LEDs, lasers, lenses, solar cells, optocouplers, fiber optics, filters, photodiodes, and other photoelectric devices) — 17 practical projects like a high performance color organ, solar-powered radios, a strobe light, a photoelectric lock, etc.

Cat. No. TAB-BOOK-836 \$5.95

MASTER HANDBOOK OF DIGITAL LOGIC APPLICATIONS, By Wm. L. Hunter. This new volume is a reference covering more than ordinary TTL... it's a modern sourcebook of design data on today's digital devices and logic systems that goes far beyond the usual requirements of common transistor/transistor logic.

It's devoted to the problems that can be solved by power-stingy CMOS, noise-immune high-threshold logic (HTL), and super high-speed emitter-coupled logic (ECL), as well as the old standby, TTL. For those demanding applications, two Chapters cover special discrete logic circuits and techniques using miniature transistors and FETs.

Cat. No. TAB-BOOK-874 \$7.95

MICROCOMPUTERS

AN INTRODUCTION TO MICROCOMPUTERS, VOL. 1 - BASIC CONCEPTS, by Osborne. takes you by the hand, from elementary logic and simple binary arithmetic through the concepts which are shared by all microcomputers. It tells you how to take an idea that may need a microcomputer and create a product that uses one. This book is complete — every aspect of microcomputers is covered: the logic devices that constitute a microcomputer system; communicating with external logic via interrupts, direct memory access, and serial or parallel I/O; microprogramming and macroprogramming; assemblers and assembler directives; linking and relocation — everything you need to know if you are going to select or use a microcomputer.

Cat. No. OSB-BUK-Z0001 \$7.50

AN INTRODUCTION TO MICROCOMPUTERS, VOL. 2 - SOME REAL PRODUCTS, by Osborne. covers real microcomputers, in considerable detail. Every major microcomputer: 4-bit, 8-bit or 16-bit, is described, including some soon to be announced products. Major chip slice products are also covered.

Cat. No. OSB-BUK-3001 \$12.50



8080 PROGRAMMING FOR LOGIC DESIGN

6800 PROGRAMMING FOR LOGIC DESIGN Both by Osborne. These are completely new books on a totally new subject: implementing digital and combinatorial logic using assembly language within an 8080 or 6800 microcomputer system. What happens to fan-in and fan-out? How do you implement a one-shot? These books describe the meeting ground of programmer and logic designer; they are written for both readers.

8080-Cat. No. OSB-BUK-4001 \$7.50
6800-Cat. No. OSB-BUK-5001 \$7.50

MICROPROCESSOR BASICS, Edited by M. Elphick. Aimed at the design engineer, this new volume on microprocessors is a collection of articles which appeared in *Electronic Design* in 1975 and 1976 under a series entitled "Microprocessor Basics."

Separate sections are devoted to each of the popular microprocessors currently available. Specific models covered in the book include the 8080, F8, 6800, 2650, 6100, 1802 and PACE. All the microprocessors mentioned are available from two or more vendors.

Each section discusses one available model, explaining its advantages and disadvantages, and its capabilities. Also included are many illustrations of the applications of each microprocessor. You won't find anywhere a more up-to-date volume on the new world of microprocessors.

Cat. No. HAY-BUK-5763 \$9.95

MICROCOMPUTER PRIMER, by Waite & Pardee. The microcomputer explosion is here! This book tells what a microcomputer is and how it works. It explores the basic concepts and characteristics of microcomputer CPUs, memories, input/output devices and interfaces, software, hardware, programming techniques and number systems.

Cat. No. SAM-BUK-21404 \$7.95

MICROPROCESSORS: NEW DIRECTIONS FOR DESIGNERS, By Edward A. Torrero. "For the hobbyist hardware expert, the book provides a fair overview of the microcomputer field; for the person more acquainted with software, it gives a good introductory look at the field from a hardware perspective." *Byte*.

This valuable book offers convenient access to the growing applications and design features in the new world of microprocessors. It's a systematic compilation of the wealth of data, information, statistics, advice and suggestions on microprocessors that has recently appeared in *Electronic Design* magazine.

Cat. No. HAY-BUK-5777 \$10.95

DIGITAL MICROCOMPUTER HANDBOOK, By Digital Equipment Corporation. Another one of DEC's well-organized, really informative books — this time covering the LSI-11 microcomputer family. It includes hardware specifications, bus and modules descriptions, module configuring info, system installation, PROM use, user-interface design, detailed processor information, and system software information for operating systems and utility programs.

DEC-BUK-EB0658 \$10.00

PROGRAMMING MICROPROCESSORS, By M. W. McMullan. A practical and comprehensive new guide to microprocessor architecture and programming, including fixed-point and floating-point arithmetic, data exchange with peripherals, flow-charting, assemblers, compilers, and other programming aids.

Here's a book that bridges the gap between elementary microprocessor programming techniques, and the more sophisticated routines now available. It shows how to make every bit count when it comes to preserving numerical accuracy, how to do arithmetic in fixed-point and floating-point formats (scaling the numbers to make most efficient use of registers and memories), and how to use the various arithmetic/logic operations to perform register manipulations and counting chores.

Cat. No. TAB-BUK-985 \$6.95

See the special NCE-recommended programming book-package on page 39

MICROCOMPUTER DICTIONARY AND GUIDE, By Sippl. and Kidd. This is both a dictionary and a guide to computer usage. Auxiliary material in seven appendices includes: definitions, acronyms and abbreviations, computer language summaries of APL, BASIC and FORTRAN number and binary switching systems, and definitions of programmable calculator terms.

Cat. No. MMM-BUK- 460010 \$19.95

HOME COMPUTERS: A BEGINNER'S GLOSSARY AND GUIDE, By Miller and Sippl. Have you been looking a book that tells you just what you need to know, without burying you in jargon or masses of irrelevant material? This book is the answer to your problem. It provides the fundamental knowledge and skill for the new micro owner.

Cat. No. MMM-BUK-398029 \$6.95

HOW TO BUY & USE MINICOMPUTERS & MICROCOMPUTERS, By Wm. Barden, Jr. This book discusses smaller members of the computer family and shows you how to become part of the mini/microcomputer revolution. The book explains basics of mini- and microcomputers, their hardware and software, the peripheral devices available and various programming languages and techniques.

Cat. No. SAM-BUK-21351 \$9.95

HOME COMPUTER PRIMER, By Charles Sippl. Written by one of the best known writers in the field, the book carefully explains the underlying principles and the way they are applied in the home computer, as well as the way to use the home computer to get the most out of it. It will take the mystery out of the computer systems that are fast becoming as much a part of life as the light bulb.

Cat. No. MMM-BUK-398037 \$6.95

STEP BY STEP INTRODUCTION TO 8080 MICROPROCESSOR SYSTEMS, By Melsa and Cohn. This more advanced book shows you how to put together what you've learned to build systems and applications that really exploit the capabilities of your micro. Includes information on machine structure, data storage, utility software, uses of terminals for I/O, editors, assemblers, interface devices, interrupts and real-time clocks, peripherals, resident software vs. cross-assemblers and time-sharing services.

Cat. No. MMM-BUK-398045 \$7.95

HOME COMPUTERS: 2ND QUESTIONS AND ANSWERS Volume 1: Hardware, By Rich Diddy. This book is for the person with a micro-computer who wants to get an idea of what it can be like to use it to the fullest. Ideas for things to do, help in reading the literature, help in deciding what ways to go — it's all here in easy-to-understand language for the beginner. Contains information on hardware, some specific microprocessors, how to put a kit together, control, communications, computation, and organization.

Cat. No. MMM-BUK-398002 \$7.95

HOME COMPUTERS: 2ND QUESTIONS AND ANSWERS Volume 2: Software, By Rich Diddy. A companion volume to the above book, this guide leads the new micro owner through the thorny problems surrounding the selections and use of software. Tells you how to program in raw machine code, assembly language, BASIC, what you can use arrays for, and all about structured programming.

Cat. No. MMM-BUK-398010 \$6.95

MICROPROCESSOR/MICROPROGRAMMING HANDBOOK, By Brice Ward. An authoritative, practical guide to the construction, operation, programming and applications of perhaps the most significant new technological achievement of our time. Tells what microprocessors are, how they work, where they're used, and how YOU can use them in your own applications! Shows you how to write the necessary programs (called microprograms) to allow your microprocessor to process and manipulate information, simulate control processes, and emulate other machines.

Cat. No. TAB-BUK-785 \$6.95

NCE recommends the special programming-book package featured on page 39

HOME COMPUTER DIGITAL ELECTRONICS, By Miller and Irwin. This book provides the beginner with some basic ideas of switching theory and digital circuits. It also introduces him to some of the most important ideas underlying the computer system — binary conversion; binary addition, subtraction, multiplication and division; octal numbers; hexadecimal numbers; and microprocessor structure and architecture.

Cat. No. MMM-BUK-398053 \$6.95

FUNDAMENTAL PRINCIPLES OF MICROCOMPUTER ARCHITECTURE, By Keith L. Doty. This book provides a complete basis for exploring the dynamic field of microcomputer systems and applications. After a general overview of the microcomputer scene, the author illustrates how general computation is a form of accounting with a decision-making capability. After developing confidence in the power of these existing devices, he proceeds to develop the notion of information and its representation as seen by the computer and the programmer. No prior programming knowledge is assumed and elementary material on programming is presented.

Cat. No. MMM-BUK-460134 cloth \$17.50

Now you can get the FIRST in Osborne's 2nd Series

SOME COMMON BASIC PROGRAMS is designed for people who can use a variety of practical BASIC programs. The programs are written in a restricted version of standard BASIC and are compatible with many versions of BASIC now available to microcomputer users. Program descriptions, examples and remarks accompany the listings to help you follow BASIC programming logic.

\$7.50 Cat. No. OSB-BUK-6002

Partial list of programs included:
Future Value of Regular Deposits (Annuity)
Regular Deposits
Regular Withdrawals from an Investment
Initial Investment
Minimum Investment for Withdrawals
Nominal Interest Rate on Investments

Linear Programming
Matrix Addition, Subtraction, Scalar Multiplication
Matrix Multiplication
Matrix Inversion
Permutations and Combinations
Mann-Whitney test

BASIC

ADVANCED BASIC APPLICATIONS AND PROBLEMS, By James S. Coen. Both professional and students doubly find that after they have been through introductory BASIC books, they're back much left on their own. This book is for those who want to extend their expertise with BASIC and use advanced techniques and applications, including coordinate geometry, area, sequences and series, polynomials, arching, simulations, and games. A special review chapter is given for those whose knowledge of BASIC is limited or distant in time. The book is also intended for those who already know another programming language and want to pick up BASIC.

Cat. No. HAY-BUK-5885

\$4.95

BASIC BASIC: AN INTRODUCTION TO COMPUTER PROGRAMMING IN BASIC LANGUAGE, By James S. Coen. This text for high school and college students introduces programming in BASIC language and the teaching of mathematics. Written in a precise, step-by-step, it is suitable either as a supplementary text with already established math courses or as the sole text in a course on programming alone.

Each topic begins with a short, complete program and progresses to more sophisticated problems. The use of flowcharts is encouraged as an aid in writing programs. Exercises and questions allow the student to gradually increase both his understanding of concepts and his ability to write programs.

Cat. No. HAY-BUK-5872

\$7.95

DISCOVERING BASIC: A PROBLEM SOLVING APPROACH, By Robert E. Smith. This book introduces programming through a practical approach to learning that motivates the reader to discover the vocabulary of the BASIC language as he develops skill and confidence in putting it to work.

The brief lessons, usually two paragraphs, are reinforced in class, course language and are followed by review problems. Over thirty-five pages of programs back up both lessons and problems. A wide range of interests including insurance, geometry, puzzles, and economics is covered in the lessons which reflect the growing importance of BASIC as a language used with time sharing systems, computer installations and for programming microcomputers.

Cat. No. HAY-BUK-5753

\$6.95

I/O DESIGN: DATA MANAGEMENT IN OPERATING SYSTEMS, By Freeman & Perry. Now you can master every facet of today's I/O systems more easily than ever before — design your systems with more confidence and accuracy. This handbook, written by two professionals with many years experience in designing and implementing programming systems, details the many I/O system and subsystem designs in use today.

Cat. No. HAY-BUK-5789

cloth \$17.50

COBOL WITH STYLE: PROGRAMMING PROVERBS, By Louis J. Chmura, Jr. The successful technique used in PROGRAMMING PROVERBS and PROGRAMMING PROVERBS FOR FORTRAN PROGRAMMERS has now been applied to COBOL. This new book features coherent, practical, and common-sense guidelines to writing perfect COBOL programs every time. Here, for the first time for the COBOL user, are standards for writing programs and prettyprinting. This handbook also features numerous examples of the best written COBOL programs in print today. Every program has been tested and thoroughly debugged.

Cat. No. HAY-BUK-5781

\$5.45

MASTER HANDBOOK OF 1001 PRACTICAL ELECTRONIC CIRCUITS, Edited by K. W. Sessions. Here are IC and transistor circuits for practically anything and everything — with ALL the data needed to put them to work. Each circuit diagram has every component carefully labeled, and every schematic is accompanied by all the info you need to construct the circuit for use in your own individual application. If there are coils to be wound, you'll find full and complete coil-winding details right there on the spot. The circuits included are completely up-to-date, and have been designed, built, tested, reworked as necessary, and perfected. You'll find any circuit you're ever likely to need in the pages of this rich volume. If you're in the business of servicing/repairing commercially built electronic equipment, you're going to especially appreciate the comprehensive Appendix of IC substitutions, which includes base diagrams for most popular ICs.

Cat. No. TAB-BUK-800

\$9.95

Included in our hardware library special — see page 37.

ANALYSIS AND DESIGN OF DIGITAL CIRCUITS AND COMPUTER SYSTEMS, By Paul Chirlian. This book is for the beginner in digital circuits and systems. It not only provides the reader with the basic ideas of switching theory, but also provides him with an understanding of the total operation of the complete computer system.

Cat. No. MMM-BUK-460037

cloth \$22.50

111 DIGITAL & LINEAR IC PROJECTS, By Don Tuite. A practical sourcebook of circuits for every taste — digital and linear — using off-the-shelf components. Complete specs and clear layout drawings are provided for every IC (including phase locked loop IC's) featured, and detailed applications into including all the values needed to make it work, accompanies each circuit project. The projects themselves, too numerous to mention, cover a broad spectrum that touches every phase of electronics — audio, computers, radio, test instruments, power supplies and regulators, and MANY more. Includes an Appendix providing basic performance data and using diagrams on 50 common and uncommon IC's.

Cat. No. TAB-BUK-780

\$5.95

See page 47 for Fairchild books.



COMPREHENSIVE STANDARD FORTRAN PROGRAMMING, By Joseph J. Heng. This text teaches how to program effectively using the full version of FORTRAN IV as standardized by the American National Standards Institute. It provides a mastery of the 37 different FORTRAN IV instructions, as well as an understanding of numeric capabilities and limitations. From the outset, portions of the language are applied in writing sample programs, and by the end of the text the reader has the capacity to solve numerous problems.

Reinforcing on previous knowledge of computer programming, the book employs examples and exercises that will permit the reader to learn how to apply the complete language in solving the problems of a variety of disciplines.

Cat. No. HAY-BUK-5811

\$2.95

FORTRAN FUNDAMENTALS, A SHORT COURSE, By Jack Steingarten. Beginning programmers with some mathematical background will find this text a fast and efficient guide to the fundamentals of FORTRAN. The main objectives are to provide an abbreviated means of learning the language, to introduce formal statements, to encourage immediate results, and to make students familiar with these language methods.

Sample problems are given, along with complete solutions. However, students are enthusiastically encouraged to try various routines and to analyze the success or failure. Questions appear throughout these and are designed to be answered with reference to the FORTRAN manual which is provided. Although the text is designed to be a fast guide for a FORTRAN class of approximately 10 hours.

Cat. No. HAY-BUK-5850

\$7.95

Your programs can be good to the last byte.

NCE's SPECIAL PACKAGE 3 PROGRAMMING BOOKS

**ONLY
\$20.50
FOR ALL 3!**

	Description on page	List price
Computer Programming Handbook	37	\$8.95
Microprocessor/Microprogramming Handbook	38	\$6.95
Programming Microprocessors	38	\$6.95
(Total list price: \$22.85)		

Cat. No. PKG-BUK-SFT01

IMSAI

Intel 8080 Microcomputer System User Manual

Cat. No. IMS-BUK-INTEL \$6

Contains complete specifications and data sheets on Intel 8080A and all associated Intel memory and peripheral chips

IMSAI 8080 User Manual

Cat. No. IMS-BUK-IMSAI \$50

Floppy Disk System and DOS-A User Manuals

Cat. No. IMS-BUK-FDS \$50

Multiprocessor and Shared Memory User Manual

Cat. No. IMS-BUK-MULT \$50

Line Printer User Manual

Cat. No. IMS-BUK-LPRT \$50

The T.I. TTL Handbook

Cat. No. IMS-BUK-TTL \$6
Contains complete electrical specifications for 7400

Supplement To TTL Handbook

Cat. No. IMS-BUK-TTLSU \$5
Adds more 7400 series descriptions; 400 pages

Pinout Handbook

Cat. No. IMS-BUK-PIN \$5
Covers the entire 5499/7400 series D.I.P.C.'s connections, functional specifications cross-reference

BASIC Plus Language Manual

Cat. No. IMS-BUK-BASICP \$17

IMSAI 8080 Microprocessor System Illustrated Catalog

Cat. No. IMS-BUK-CAT \$1

INTEL 8080 Assembly Language Manual

Cat. No. IMS-BUK-INASM \$12
How to program the 8080 in assembly language

(allow 30 days for delivery, IMSAI books only)

microcomputer equipment

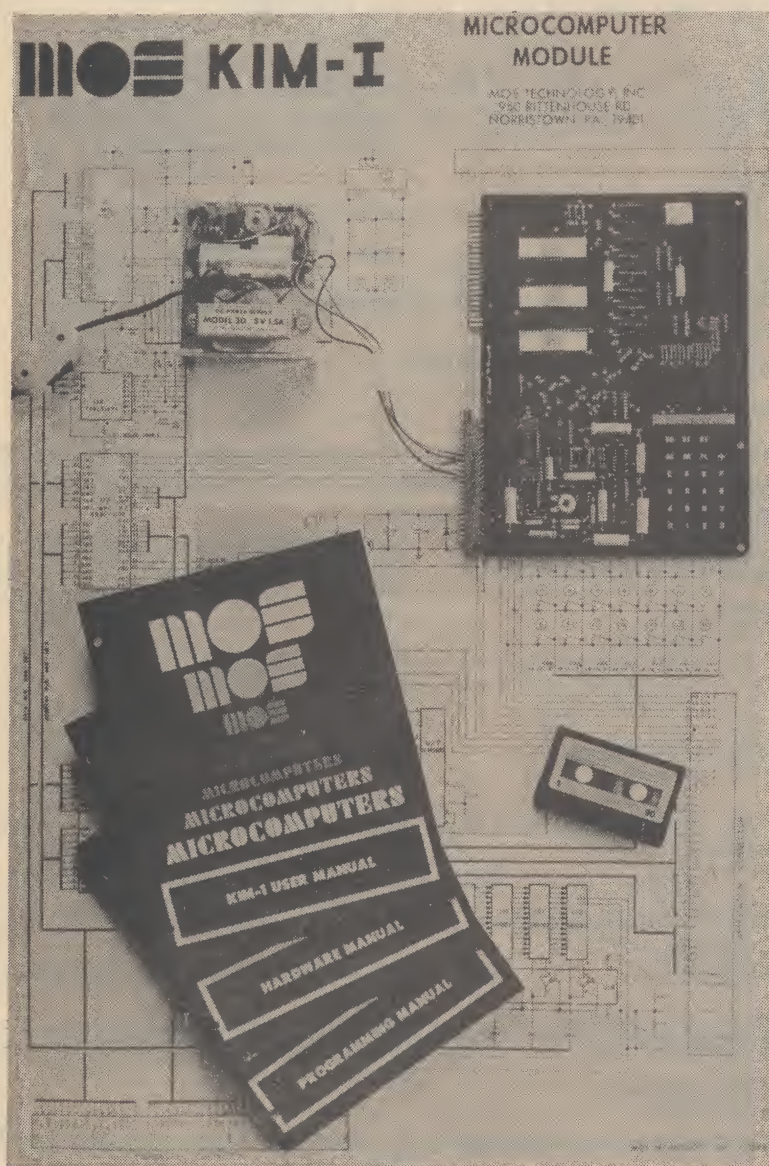
A Complete Computer System Just \$279

KIM-1-The NOW Microcomputer!

A complete computer system on a single printed circuit card. A powerful microprocessor system completely assembled and tested at a price far less than most kits. The KIM-1 includes the MOS Technology, Inc. 6502 microprocessor array; an 8 bit MPU with a powerful instruction set, 13 addressing modes, multiple interrupts and a full 65K address range (16 bits).

KIM-1-Who Can Use It

The industrial, commercial, office and educational user as well as the hobbyist/enthusiast will find the KIM-1 system an excellent, inexpensive learning device to introduce the numerous applications a microprocessor can offer to industry education and the home.



No Kits!

Everything:

- Fully Assembled
- Fully Tested
- Fully Warranted

CompuMart's KIMPAC Includes

- **KIM-1** — Computer Module from MOS Technology 1K RAM, 2K ROM continuing system executive, complete audio cassette interface, 15 bidirectional I/O lines, a 24-key keyboard, and a six-digit LED display.
- **System Power Supply** (plus 5V at 1.2A, plus 12V at 0.1A) with power line and switch.
- **Software** — System Executive (stored in 2048 ROM Bytes) Sample application programs (stored on included cassette) and listings.
- **Documentation** — "The best programming and hardware manuals in the business," *Interface*, Mar. '76.
KIM-1 User manual
KIM-1 System Schematic, wall size
6500 Hardware Manual
6500 Programming Manual
6500 Programmer's Reference Card

All these low cost peripheral interfaces available

- CRT Memory & Controller
- Cassette Recorder
- Terminals
- Printers
- Video Interface with 512 Byte RAM

\$279 with power supply

Cat. No. MOS-COM-KIM1

\$245 without power supply

Cat. No. MOS-COM-KIMNPS

Manuals available for Evaluation. Refundable!

Evaluate for yourself what an outstanding value the KIM-1 is.

For \$29.50 we will send you the KIM-1 user manual, hardware manual, and programming manual. Hundreds of pages of useful reference material.

If you buy a KIM-1 from CompuMart within 90 days we will deduct \$29.50 from the purchase price.

Cat. No. MOS-DOC-KIM1

Newman Computer Exchange The KIM Experts

KIM-1

A System to Grow With

Need more memory or I/O for more complex applications? KIM-1 is only the starting point. Expansion of the system to include up to 65K is simplified since all required address bus, data bus, and control signals are available at one of the KIM-1 connectors. Memory may be of any type you choose (ROM, RAM, PROM; Static or dynamic; high speed or low speed). I/O expansion is just as easy since every I/O port is addressed as if it were a normal memory location.

KIM-1

A Choice of Peripherals

NCE has the peripherals you need. From the simple ASR33 Teletype to the more sophisticated CRT display. You may also add our optional audio cassette unit to your KIM-1 system to provide permanent bulk storage for programs and data (no need to blow expensive PROMS!) All required interface circuits for recording and playback of audio cassettes are included in the KIM-1 system.

Cassette Recorder

Cat. No. BMK-CAS-M2522...\$55

AC/Battery recorder specially selected for KIM-1. Features automatic stop at end of tape, automatic record level control on record, 60 Hz to 8 KHz bandwidth, built-in condenser mike for voice. ID recording, and a digital tape counter for quick program access.



Edge Connector for the KIM-1

22/44 Contacts. Vector R644. Solder Tail.

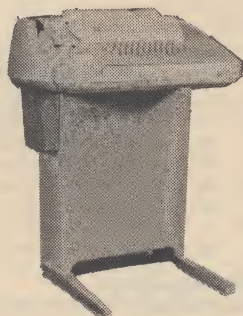
Cat. No. KIM-ACC-R644 \$4.32

22/44 Contacts. Vector R644-1. Wire Wrap Tail.

Cat. No. KIM-ACC-R6441 \$7.20

ASR 33

10 cps paper tape reader, 10 cps paper tape punch and 10 cps friction feed printer. This teletype has been modified such that the paper tape reader and punch are under control of the KIM-1. Rebuilt versions come with full 90 day warrantee.



\$925 (Fully Rebuilt)

REMEMBER!

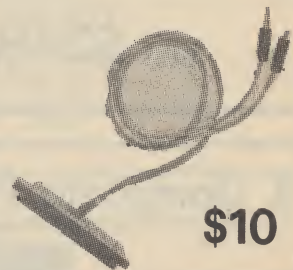
20% OFF

on any peripheral supplies ordered with the peripheral. See page 32 for a complete listing.

Cassette Interface Cable

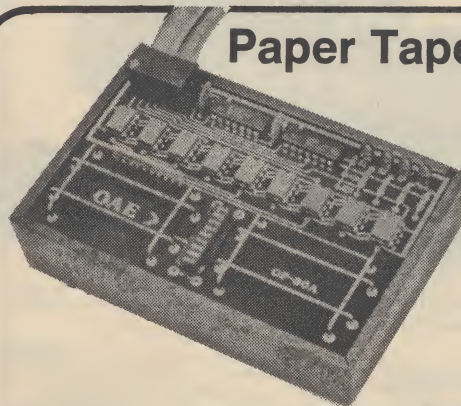
Cat. No. KIM-IOX-RCDR3

Completely assembled, 3-foot shielded cable with one 22/44 edge connector directly pluggable into KIM-1, and fitted with two phono jacks which plug into your cassette recorder.



\$10

Paper Tape Reader



\$95

This unit has no moving parts, will read punched tape as fast as you call pull it through (0-5000 cps c.p.s). It includes a precision optical sensor array, high speed data buffers, and all required handshake logic to interface with any microprocessor parallel I/O port. Assembled.

Cat. No. OAE-PTP-RDR

PLEASE

A Games and Demo Package for your KIM-1

A small user developed package designed to run on the basic KIM-1, without any additional peripherals. Includes a simple number guessing game, a more sophisticated one (also known as Mastermind), a shifting billboard display, shooting stars puzzle and a 6 digit adding machine.

Object cassette tape and operating instructions, Cat. No. RMT-DOC-POCT \$6.00

Source listing and instructions for writing code, Cat. No. RMT-DOC-PSL \$6.00

Complete PLEASE Package including everything, Cat. No. RMT-DOC-PP \$10.00

and for your KIM the CompuMart VRAM



VRAM AND CRT ORGANIZATION

Just **\$249**

The CompuMart VRAM was designed to allow the KIM-1 user to display alphanumeric information on a TV monitor. This module generates 16 lines of 32 characters. All 128 ASCII codes are available including upper case, lower case, numbers and special symbols as well as blinking characters. Each character is integrated within a 7 x 9 dot matrix so that very high quality characters are displayed.

VRAM means Video Random Access Memory, and so they are, both models providing you with 512 more bytes of memory to write into and read from! That means that what you display you can use in your program. You can even load a program into VRAM and run it! (A rather weird display, but completely identifiable!) And you can load from the cassette or

TTY directly into your VRAM and whatever you load will appear on your monitor.

Now, the best part of all: while the VRAM is constantly displaying its contents, no programming is needed, no time is taken from KIM-1. The display is automatically and continuously refreshed at standard video rate. However, if you wish, the VRAM will furnish you an interrupt signal which may be directly connected to either IRQ or NMI interrupt inputs, and these interrupts may be either horizontal line or vertical frame intervals. If you do all your VRAM content modifying during either the horizontal or vertical retrace times, then the display will never show unsightly "flashes" or flickers! In this way, you may make most professional displays.

A Complete Floppy Disk System for your Altair/IMSAI

for Only **\$699 kit**



Micro-Disk System **\$699**

Cat. No. NSC-DSK-MDSK

(Assembled) **\$799**

Cat. No. NSC-DSK-MDSA

Additional Drives **\$425 ea.**

Cat. No. NSC-OSK-AD

Diskettes **\$4.50 ea.**

Cat. No. NSC-SUP-DSKT

That's right, complete.

The North Star MICRO-DISK SYSTEM[™] uses the Shugart minifloppy[™] disk drive. The controller is an S-100 compatible PC board with on-board PROM for bootstrap load. It can control up to three drives, either with or without interrupts. No DMA is required.

No system is complete without software: NSC provides the PROM bootstrap, a file-oriented disk operating system (2k bytes), and NSC's powerful extended BASIC with sequential and random disk file accessing (10k bytes).

Each 5" diameter diskette has 90k data byte capacity. BASIC loads in less than 2 seconds. The drive itself can be mounted inside your computer, and use your **existing** power supply (.7 amp at 5V and 1.6 amp at 12V max). Or, if you prefer, we offer a power supply (\$39) and enclosure (\$39).

Included: North Star controller kit (highest quality PC board and components, sockets for all IC's, and power regulation for one drive), SA-400 drive (assembled and tested), cabling and connectors, 2 diskettes (one containing file DOS and BASIC) complete hardware and software documentation.

An 8080 Compatible card that performs Decimal Floating Point Arithmetic Operations 50 times Faster than 8080 Firmware

FPB DATA SHEET EXECUTION TIMES 1, 2, 3

PRECISION DIGITS:	2	4	6	8	10	12	14
ADD best	1	1	1	1	1	1	1
typical	8	8	9	9	10	10	11
worst	10	10	10	11	11	12	12
SUBTRACT best	4	4	4	4	4	4	4
typical	8	8	9	9	10	10	11
worst	15	16	17	18	19	20	21
MULTIPLY best	5	5	5	5	5	5	5
typical	18	34	55	80	11	146	186
worst	51	125	228	382	527	720	933
DIVIDE best	7	7	7	7	7	7	7
typical	39	70	109	156	211	274	370
worst	62	139	229	340	470	621	779

1. Times given in microseconds
2. Execution times are a function of the input values
3. Times listed do not include transmission of input values and result

As low as **\$359 kit**
Cat. No. NSC-IOX-FPBA

\$499 assembled

Power requirements:

Model A: 8V (unregulated) @ 1.7 A

Model B: 5V (regulated) @ 1.7 A

Board dimensions:

Model A: 5 in. by 10 in.

Model B: 6 1/4 in. by 12 in.

Board Construction:

FR4 material, gold plated edge connectors

Floating point number representation:

Byte 1: bit 7=sign (1=negative number, 0=positive number)

bits 6-0=exponent in excess 64 binary representation

bits 7-0=zero represents the zero value

Byte 2: bits 3-0=least significant digit of value in BCD coding

bits 7-4=next least significant digit of value

Byte n: bits 7-4=most significant digit of value in BCD coding

bits 3-0=next most significant digit of value

All values are normalized.

Other representations of BCD floating point numbers require a change in microcode and are available on special order.

Micro or Mini Processor VIDEO DISPLAYS

Video Ram's from MATROX

Video Ram

Every computer system requires a number of I/O interfaces to communicate with various peripheral devices. A new and different design approach for interfaces is necessary if they are to be effectively used in microcomputer systems. The architecture of the interface has to be such that the peripheral device can be easily connected to the CPU (hardware and software). Secondly, to save CPU time the I/O interface should control the peripheral device with minimum supervision from the CPU. Furthermore, the I/O interface has to be microprocessor compatible with regard to size, power consumption, speed and cost.

The MTX family of TV CRT controllers has been designed to meet the above requirements. Several types of controllers are available.

The **MTX-816 VIDEO RAM** display is organized in 8 lines x 16 characters. Applications of this RAM are mainly found in systems requiring display of large characters (navigation, communication, process control, test equipment).

Cat. No. MTX-IOX-816

\$179.

The **MTX-1632 VIDEO RAM** is intended for applications that require the display of a large number of alphanumeric characters (upper and lower case; Greek letters, symbols). The display is organized in 16 lines of 32 characters each (total 512).

Cat. No. MTX-IOX-1632

\$225.

The **MTX-2480 VIDEO RAM** displays 24 lines of 80 characters each (total 1920). Upper and lower case, half intensity, blink, inverse video are some of the standard features of this RAM.

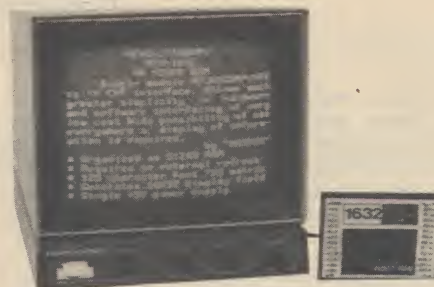
Cat. No. MTX-IOX-2480

\$395.

The **MTX-256★2 GRAPHIC SYSTEM** is a unique modular graphic system which displays a 256 x 256 dot raster on any monochrome or color TV monitor. Grey scale, color, image motion, light pen, cursor plot, vector plot, point plot, alphanumerics and ROM screen patterns are easily implemented.

Cat. No. MTX-IOX-256

\$630.



MTX - 1632

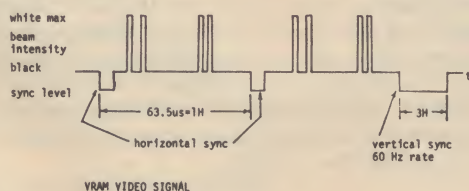
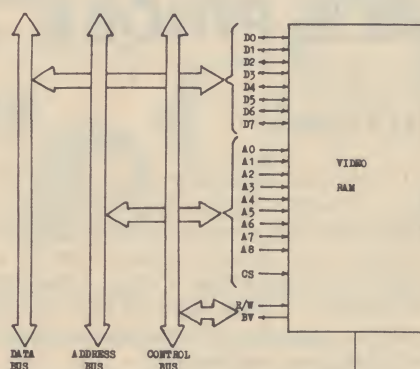
Interfacing to a Microcomputer

On the input side a VRAM looks like a static random access memory and it can be directly connected to the data and address bus of a typical microprocessor system. Each character position on the screen is equivalent to a memory location. It can be written into and read out the same way as any other RAM in the microprocessor address space. The content of a video memory location determines the character to be displayed. Various display effects can be accomplished with the availability of the Read/Write feature.

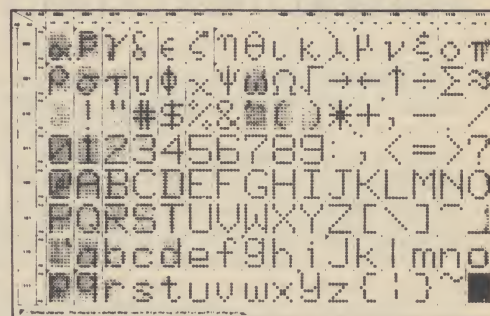
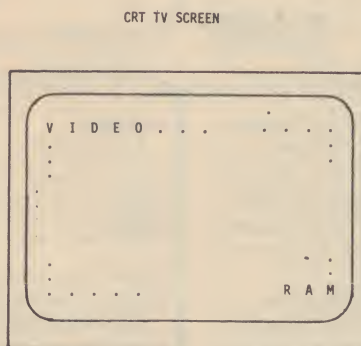
The VRAM bus interface shown in Fig. 2 demonstrates the simplicity of interface to a typical bus system. Data, address and control lines can be connected without buffers. The CS (chip select) input is used to select the VRAM in the microprocessor address space.

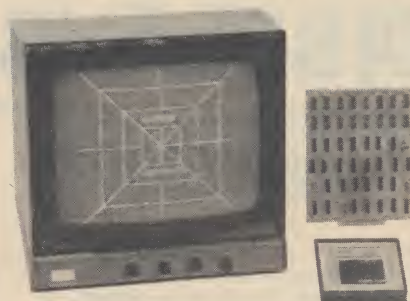
A CRT display is refreshed at 60 Hz rate. However, there is no need for the CPU to refresh the VRAM; once written a character is continuously displayed until a new character is rewritten into a location. This unique feature is a significant improvement over the commonly

VRAM AND CRT ORGANIZATION



ADDRESS									DATA								ASCII
A8	A7	A6	A5	A4	A3	A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0	
0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	V
0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	I
.	.	.	.	.	.	0	0	1	0	0	0	0	0	1	0	0	D
.	.	.	.	.	.	0	0	1	0	0	0	0	0	1	0	0	E
.	.	.	.	.	.	0	1	0	0	0	0	0	1	1	1	1	O
.	.	.	.	.	.	0	1	0	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	1	0	1	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	1	0	1	0	0	0	1	0	0	1	0	R
1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	A
1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	M
1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0	1	.





used DMA approach, since it requires no CPU time for refresh. The VRAM refreshes the picture automatically, scanning continuously the internal memory to produce a video signal. The video signal consists of horizontal and vertical sync. pulses (used to synchronize the TV scan) and the video portion which modulates the intensity of the electronic beam. During horizontal and vertical synchronization there is no video displayed to allow for the beam flyback.

Driving the TV Monitor

A VRAM produces a composite video signal which drives directly any standard TV monitor. A 75 Ohm output impedance permits connection of a 75 Ohm cable of up to 2000 feet to drive a terminated TV monitor. Synchronization frequencies are crystal controlled so that low cost TV monitors can be used without picture degradation. Short circuit protection on the video output is built in (video only and sync. signals are also available as separate outputs).

	MTX-816	MTX-1632	MTX-2480	MTX-256**2
DISPLAY FIELD	8x16	16x32	24x80	256x256
CHARACTER MATRIX	5x7	7x9	7x9/5x7	DOT
CHARACTER SET	64	128	128/64	GREY/COLOR
UPPER/LOWER CASE	NO	YES	YES	—
BLINK	NO	YES	YES	—
1/2 INTENS; INVERSE VID.	NO	NO	YES	YES
COMPOSITE VIDEO	YES	YES	YES	YES
AMERICAN TV STD. (60 Hz)	YES	YES	YES	YES
EUROPEAN TV STD. (50 Hz)	YES	YES	YES	YES
COLOR	NO	NO	NO	YES
REMOTE DISPLAY	YES	YES	YES	YES
NO. OF CHARACTERS	128	512	1920	65,536
PACKAGING	MODULE	MODULE	PC BOARD	PCB/MODULE
DIMENSIONS (INCHES)	3.2x4.4x.6	3.9x4.4x.5	7x7.5	6x6.5/4x4x.5
CONNECTIONS	24 PINS	28 PINS	CONN.(44 PINS)	CONN.(44 PINS)
OPERATING TEMP.	0-70°C	0-70°C	0-70°C	0-70°C
POWER SUPPLY (MAX.)	+5V, 200mA	+5V, 600mA	+5V, 1.5A	+5V, .4A; +12V .12A
COMPATIBILITY	CMOS, TTL	TTL	TTL	TTL
WRITE ACCESS TIME ns	900	650	500	80
READ ACCESS TIME ns	975	450	500	—
MEMORY ORGANIZATION	128x8	512x8	4096x9	65,536x1
PRICE (SINGLE)	\$179.	\$225.	\$395.	\$630.
CAT. NO.	MTX-IOX-816	MTX-IOX-1632	MTX-IOX-2480	MTX-IOX-256

Options

- MTX-1632 SLVRAM module (external sync. version of MTX-1632) can be synchronized from the external TV sync. source (TV camera, MTX-256**2). This unit provides alphanumeric which can be added to the TV camera video or graphics signal.
- All VRAMs are available in American (60 Hz) or European (50 Hz) TV standard.

SALE PRICES on CRT controllers for the IMSAI/ALTAIR S-100 BUS

MATROX ALT-2480

\$295 Cat. No. MTX-IOX-2480AT

The ALT-2480 is a TV CRT controller module which generates a video signal that can drive directly any standard TV monitor (10 MHz bandwidth min.). The display is 1920 ASCII alphanumeric characters arranged in a 24 line x 80 column matrix. Characters are normally displayed white on a black background. In addition, any character can be shown as black on white (inverse video), half intensity, or blinking. Upper and lower case character fonts (CRT must have long persistence phosphor) and upper case font only (CRT can have standard phosphor) are available.

Fully S-100 compatible, this board contains 2K of read/write memory which

is configured to select character position with a 12-bit address. The address bits 0-6 select the column, bits 7-11 select the row. This addressing scheme requires 4K of memory space which can be jumpered to occupy any 4K page (i.e. 0-4K, 16-20K). A jumper-selectable option allows 48 lines of 40 characters to be used in place of the normal 24 x 80. With this arrangement 24 lines are displayed and 24 are hidden. The hidden page is displayed by writing a character to any address within page. Access time is less than 500 nsec. for the board which uses +5 volts.

MATROX ALT-256**2

HIGH RESOLUTION GRAPHICS

\$395 Cat. No. MTX-IOX-256AT

TOTAL CONTROL OVER A FIELD OF 65,536 INDIVIDUALLY ADDRESSABLE LOCATIONS!

The Matrox ALT-256**2 board is a fully tested, assembled and burned-in interface card which provides capability for a complete graphic system at a fraction of the cost of any other commercial graphic system. The card contains all interface electronics, a TV sync generator, and its own 65,536 x 1 bit refresh memory. It plugs directly into one slot of any S-100 bus compatible computer. The built in refresh memory allows much greater flexibility and speed since no CPU time is required to refresh the screen.

The output is a composite video signal which can be connected to any TV monitor or the video portion of a TV set. The unit produces a high resolution 256 x 256 dot raster. The complete screen can be cleared or preset by a single

instruction.

The ALT-256**2 board occupies a single S-100 bus slot and requires 4 output ports and 1 input port (port address is selectable on the card with jumpers). The four output ports are used for loading data into the display memory.

Power Requirements: 8V, 600 mA; 18V, 100 mA; -18V, 10 mA

Outputs: composite Video; 75 Ohm, crystal controlled; TTL video, horizontal and vertical syncs and blanks outputs

Remote Display: 75 Ohm cable, up to 2,500 feet; multiple monitors, up to 25 TV's

SOLDERLESS BREADBOARDING FROM NCE

by Continental Specialties Corporation

QUICK TEST SOCKETS & BUS STRIPS!

Design and build circuits as fast as you can think!

Keep going non-stop, from idea stage to final design, using the same components over again without bending, twisting or loading with solder. The fast, reliable Quick Test Sockets and Bus Strips let you try out new ideas or rejuvenate old ones with complete safety to your discrete and IC components and your fingers.

ACCEPTS ALL STANDARD COMPONENTS Quick Test Sockets and Bus Strips conform to 1/10" grid and are DIP compatible. ICs, diodes, resistors, capacitors, transistors, etc. are plugged right into the socket and/or strip, without messy, time-consuming soldering.

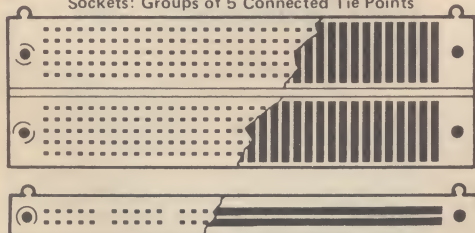
HOOK-UP All you need is a wire stripper and #22-30 AWG solid hook-up wire. Connect power and ground leads to your bus strip. Plug in your ICs, transistors, resistors, etc. Now interconnect components with #22-30 AWG wire. Connect a signal source to bus strip or directly to input point of your circuit. Each socket has 5 tie points per terminal; each bus strip has 2 separate rows of interconnecting terminals. Turn on the power and signal source. Hook-up a scope probe, counter, etc. Then, if you have to add a wire, need another IC or component—just plug it in. You'll never burn your fingers or get solder shorts. And you don't need any special patch cords, either.

SIMPLE MOUNTING Mounting holes in the housing let you top mount to any flat surface with 4-40 flat head screws, or 6-32 self-tapping screws for behind-the-panel mounting.

INTERCONNECTIONS Each terminal consists of 5 connected solderless tie points formed from a pre-stressed, spring-loaded noncorrosive alloy to insure secure mechanical and low resistance electrical connections.

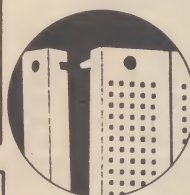
All Sockets are 1.32" wide. All Bus Strips are .36" wide. All Sockets and Bus Strips are .33" thick. And all are great for high temperature operation—for worst case circuit design to 100°C.

Sockets: Groups of 5 Connected Tie Points



2 Buses of Interconnected Terminals — 5 Tie Points Each

*U.S. Pat. Des. No. 235554



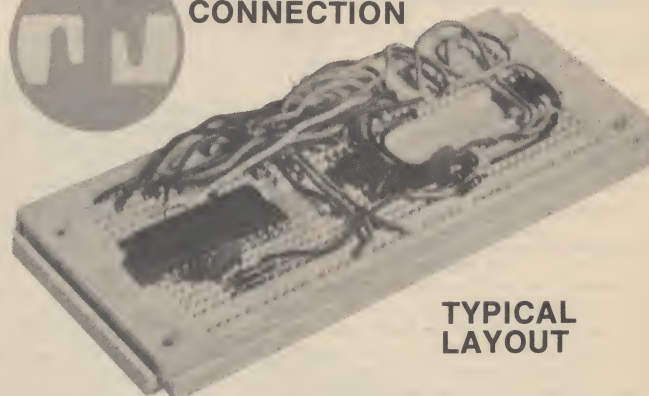
Exclusive SNAP/LOCK allows you to expand or contract your breadboard by snapping together as many sockets or strips as you need.

MODEL No.	Length	Hole to-Hole	Terminals	Unit Price \$
CSC-PRO-QT59S	6.5"	6.2"	118	12.50
CSC-PRO-QT59B	6.5"	6.2"	20	2.50
CSC-PRO-QT47S	5.3"	5.0"	94	10.00
CSC-PRO-QT47B	5.3"	5.0"	16	2.25
CSC-PRO-QT35S	4.1"	3.8"	70	8.50
CSC-PRO-QT35B	4.1"	3.8"	12	2.00
CSC-PRO-QT18S	2.4"	2.1"	36	4.75
CSC-PRO-QT12S	1.8"	1.5"	24	3.75
CSC-PRO-QT8S	1.4"	1.1"	16	3.25
CSC-PRO-QT7S	1.3"	1.0"	14	3.00

EXPERIMENTOR™* — Breadboarding Sockets



UNIQUE MODULAR CONNECTION



TYPICAL LAYOUT

SPECIFICATIONS				TIE POINTS (550)	
Model	Length	Width	Center Channel	5 Tie Point Terminals	Bus Strips
300	6.0"	2.1"	.3"	94 (470)	2 (80)
600	6.0"	2.4"	.6"	94 (470)	2 (80)

Both units are .375" deep

New Low cost breadboard sockets with unique modular expandability for mini and maxi projects.

CSC's EXPERIMENTOR sockets let you design, assemble and modify circuits as fast as you can push in — or pull out — component leads. On a rugged one-piece socket with 550 solderless tie-points (94, five-point terminals and two 40-pin bus strips).

SOCKETS LOCK TOGETHER AND SNAP APART TO HANDLE ANY SIZE CIRCUIT WITH EASE

CSC EXPERIMENTOR sockets are precision-molded of durable, abrasion-resistant material, and feature CSC's noncorrosive, pre-stressed nickel-silver contacts for positive connections and longer life. All contacts are identified, too... with molded-in alpha-numerical designations for easier circuit assembly and diagramming.

CSC EXPERIMENTOR sockets end the "big-chip blues". They're the only solderless breadboarding sockets with full fan-out capabilities for microprocessors and other larger (40 pin) DIP's, as well as for 16-pin units. EXPERIMENTOR 600's 0.6" center is ideal for microprocessors' clock chips, RAM's, ROM's, PROM's, etc. While EXPERIMENTOR 300's smaller 0.3" center is perfect for smaller DIP's. Both units of course, accept transistors, LED's, resistors, capacitors, pots — virtually all types of components with plug-in ease. As well as #22-30 AWG solid hook-up wire for interconnections.

With CSC EXPERIMENTOR sockets, you can arrange your breadboard to suit your circuit... instead of vice versa. An exclusive snap-together interlocking system lets you instantly connect them. Vertically or horizontally. So you can mix or match 0.3" and 0.6" centers... expanding or contracting to meet your requirements.

CSC EXPERIMENTOR sockets can be used alone, or mounted on any convenient flat surface, thanks to molded-in mounting holes and vinyl insulation backing that prevents shorts. You can mount them with 4-40 flat head screws from the front, or 6-32 self-tapping screws, from the rear. But however you use them, EXPERIMENTOR sockets are an unbeatable way to build and test twice the projects in half the time.

Cat. No. CSC-PRO-E600
MODEL 600
PRICE **\$10⁹⁵**

Cat. No. CSC-PRO-E300
MODEL 300
PRICE **\$9⁹⁵**

*Patent Design No. 235554

SOLDERLESS BREADBOARDING SYSTEMS

PROTO-BOARD® UNITS

Whatever type of electronic circuits you work with, you can do more with CSC's solderless proto-board systems. Build, test, modify expand, or simplify your circuit design without time-consuming soldering. Compatible with all types of components, I.C.'s, digital and linear, discrete components; resistors, capacitors, diodes, transistors, LED's etc. Interconnections between components are made with short lengths of solid hook-up wire.

Each Proto-Board contains an array of QT Sockets and Bus Strips, a sturdy base plate with one or more five-way binding posts for power and ground leads, and vinyl feet prevent scratching or slipping on your work surface.

Except for the PB/6 and PB-100 Kits, each proto-board is preassembled, factory tested and ready for you to start designing and building.

PROTO-BOARD 6 KIT — \$15.95

Cat. No. CSC-PRO-PB6

- 630 Solderless Tie-Points at 2.5¢ Apiece
- Six 14-Pin Dip Capacity
- Lowest-Priced Precision Solderless Breadboarding Kit Available

The most compact, most economical way to take advantage of Proto-Board speed and convenience. Comes with one pre-assembled QT-47S breadboarding socket, two assembled QT-47B bus strips, four 5-way binding posts, metal ground/base plate, non-marring feet and all required hardware. Follow the easy assembly instructions enclosed, using pliers and screwdrivers — you're less than 10 minutes away from starting your first circuit. Measures just 6" long x 4" wide x 1.4" high (152 x 102 x 34mm). Weighs only 7 oz. (.20Kg).

PROTO-BOARD 100 KIT — \$19.95

Cat. No. CSC-PRO-PB100

- 760 Solderless Tie-Points at 2.6¢ Apiece
- Ten 14-Pin Dip Capacity
- More Capacity at Low Kit Price

Larger (21%) capacity than the PB-6 above, yet still gives you the economy of a Proto-Board in kit form. Comes with two pre-assembled QT-35S breadboarding sockets, one assembled QT-35B bus strip, two 5-way binding posts, pre-drilled and screened baseplate, non-marring feet and all required hardware. Assembly is a breeze: complete instructions are furnished, so all you need is a screwdriver, pliers and a few minutes. Measures just 4.5" wide x 6" long x 1.4" high (114 x 152 x 35mm). Weighs only 7.5 oz. (.21 Kg).

PROTO-BOARD 101 — \$29.95

Cat. No. CSC-PRO-PB101

- 940 Solderless Tie-Points at 3¢ Apiece
- Ten 14-Pin Dip Capacity
- A Mini-Breadboard at a Micro-Mini Price

CSC's most compact fully-assembled breadboard gives you substantial capacity on a budget and is ideal for most smaller projects. Gives you two QT-35S breadboarding sockets plus four QT-35B bus strips (giving you 8 bus lines!) mounted on a rugged metal ground/base plate, with non-marring feet. Excellent for a wide variety of audio and smaller digital projects, especially where space is at a premium. Measures 4.5" wide x 5.8" long x 1.4" high (114 x 147 x 35mm); weighs 9 oz. (.26 Kg).

PROTO-BOARD 102 — \$39.95

Cat. No. CSC-PRO-PB102

- 1240 Solderless Tie-Points at 3¢ Apiece
- Twelve 14-Pin Dip Capacity
- Mid-Sized Capacity at a Mini Price

For experimentors with needs for larger breadboarding capacity, CSC offers the PB-102.

In a relatively compact space, it offers 32% greater capacity than the PB-101, including 8 full-size distribution buses. Gives you two QT-47S breadboarding sockets plus three QT-47B and one QT-35B bus strips on a heavy-duty metal ground/base plate, with non-marring feet. Excellent for intermediate digital needs, more complex audio circuits and a wide variety of other projects. Measures 4.5" wide x 7" long x 1.4" (114 x 178 x 35mm); weighs just 10 oz. (.31 Kg).



PROTO-BOARD 103 — \$59.95

Cat. No. CSC-PRO-PB103

- 2250 Solderless Tie-Points at 2.7¢ Apiece
- Twenty-four 14-Pin Dip Capacity
- Large-Scale Capacity at a Surprisingly Reasonable Price

For advanced experimentors with larger projects in mind. Over 81% more capacity than the PB-102, this Proto-Board offers the versatility and flexibility to take on all but the very largest circuits. Great flexibility is provided by 10 distribution buses and a roomy layout. PB-103 gives you three QT-59S breadboarding sockets, four QT-59B and one QT-47B bus strips, plus four 5-way binding posts, all mounted on a rigid, heavy-duty metal ground/base plate, with non-marring feet. Lets you build calculators, interfaces, complex switching circuits, networks, etc. with ease. Measures 6" wide x 9" long x 1.4" high (152 x 229 x 35mm); weighs just 1.25 lb. (.57 Kg).

PROTO-BOARD 104 — \$79.97

Cat. No. CSC-PRO-PB104

- 3060 Solderless Tie-Points at 2.6¢ Apiece
- Thirty-two 14-Pin Dip Capacity
- Enormous Flexibility and Unmatched Capacity at an Affordable Price

The largest breadboard CSC makes. Capacity enough to tackle the biggest, most complex jobs with ease. Gives you maximum flexibility thanks to its 14 distribution buses and vast number of tie-points. PB-104 gives you the advantage of four QT-59S breadboarding sockets, seven QT-59B bus strips and four 5-way binding posts, all solidly anchored to a rigid, heavy-duty metal ground/base plate, with non-marring feet. Build a CPU, encoder, complex display... just about anything you have a mind to. Measures 8" x 9.8" long x 1.4" high (203 x 248 x 35mm) and weighs only 1.75lb. (.79 Kg).

*U.S. Pat. Des. No. 241252

"FEATHERWEIGHT" WIRING PENCIL

Vector Wiring Pencil P173 consists of a hand-held tool which is used to guide and wrap insulated wire, fed off a self-contained replaceable bobbin, onto component leads as well as terminals installed on pre-punched "P" Pattern Vectorboard. Connections between the wrapped wire and component leads, pads, or terminals are made by soldering. Complete with 250 feet of red wire.

Cat. No. VEC-TUL-P173

\$9.50

Replacement wire bobbins
Package of 3

\$2.40

Cat. No.

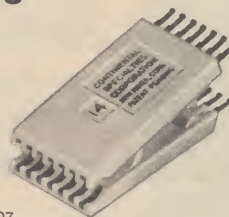
Cat. No.

VEC-PTS-W363A (Green)
VEC-PTS-W363B (Red)

VEC-PTS-W3630 (Clear)
VEC-PTS-W363D (Blue)



PROTO-CLIPS*



*U.S. Pat. Des. No. 3914007

	Price	Catalog No.
PC-14 (14 pin)	\$ 4.50	CSC-PRO-PC14
PC-16 (16 pin)	\$ 4.75	CSC-PRO-PC16
PC-24 (24 pin)	\$ 8.50	CSC-PRO-PC24
PC-40 (40 pin)	\$13.75	CSC-PRO-PC40

FAIRCHILD SOLID STATE TECHNOLOGY KITS

OPTOELECTRONICS

Cat. No.	Description	Price
DIGITS		
FCH-PTS-0001	0.5" C.C. Digit	2.30
FCH-PTS-0002	0.5" C.A. Digit	2.30
FCH-PTS-0003	.357" C.C. Digit	2.00
FCH-PTS-0004	0.8" C.C. Digit	3.45
FCH-PTS-0005	0.8" C.A. Digit	3.45

DISPLAY ARRAYS

FCH-PTS-0010	8000	10.35
FCH-PTS-0011	8024	11.00

LAMPS

FCH-PTS-0020	10 Red Lamps	2.30
FCH-PTS-0021	5 Mixed Lamps	2.30
FCH-PTS-0022	FLS 010	2.30
FCH-PTS-0023	FLS 011	2.30

PHOTO TRANSISTORS

FCH-PTS-0030	5 Flat P-Tran.	2.30
FCH-PTS-0031	5 Round P-Tran.	2.30
FCH-PTS-0033	3 Round Darling.	2.30

PHOTO ARRAYS

FCH-PTS-0040	9-Element Tape Reader Array	22.00
FCH-PTS-0041	12-Element Card Reader Array	33.00
FCH-PTS-0042	Reflective Opto Coupler	5.75

COUPLERS

FCH-PTS-0050	3 Opto Couplers	2.30
FCH-PTS-0051	Darl. Coupler	2.30

MOS CLOCK CIRCUITS

FCH-PTS-0400	FCM 7001	10.35
FCH-PTS-0401	FCM 7002	10.35
FCH-PTS-0402	FCM 3817A	8.05
FCH-PTS-0403	FCM3817D	8.05
FCH-PTS-0405	FCM 7015	9.20



DIGITAL

Cat. No.	Description	Price
FCH-PTS-T000	3 Quad 2-Input NAND Gates	2.60
FCH-PTS-T001	3 Quad 2-Input NAND Gates (open collector)	2.60
FCH-PTS-T004	3 Hex Inverters	2.60
FCH-PTS-T005	3 Hex Inverters (open collector)	2.60
FCH-PTS-T008	3 Quad 2-Input AND Gates	2.60
FCH-PTS-T010	3 Triple 3-Input NAND Gates	2.60
FCH-PTS-T020	3 Dual 4-Input NAND Gates	2.60
FCH-PTS-T047	3 BCD to 7-Segment Decoder/Drivers	2.60
FCH-PTS-T074	4 Dual D Flip-Flops	4.05
FCH-PTS-T075	3 4-Bit Latches	4.05
FCH-PTS-T076	4 Dual JK m/s Flip-Flops	4.05
FCH-PTS-T090	1 Decade Counter	1.45
FCH-PTS-9368	1 LED Digit Driver/Latches	2.90
FCH-PTS-9374	1 LED Digit Driver	2.90

Cat. No.	Description	Price
KITS		
FCH-PTS-0100	Clock Calendar with Radio Applications	38.50
FCH-PTS-0106	Auto Clock Calendar	44.00

LINEAR

FCH-PTS-805M	5V 3-Terminal Medium Current Positive Voltage Reg.	2.90
FCH-PTS-808M	8V 3-Terminal Medium Current Positive Voltage Reg.	2.90
FCH-PTS-805K	1A 5V Positive Voltage Regulator	2.90
FCH-PTS-805L	5V 3-Terminal Positive Voltage Regulator	1.45
FCH-PTS-906M	5V 3-Terminal Medium Current Negative Volt. Reg.	2.90
FCH-PTS-912M	12V 3-Terminal Medium Current Negative Volt. Reg.	2.90

SMALL SIGNAL/DIODE/BPM/ECL/POWER

Cat. No.	Descriptions	Price
FCH-PTS-4003	8 1A, 50V General Purpose Glass Rectifiers	1.45
FCH-PTS-4148	20 100V 4ns Computer Diodes	1.45
FCH-PTS-3000	8 NPN Small Signal General Purpose Amp & Switch	1.75
FCH-PTS-3001	8 PNP Small Signal General Purpose Amp & Switch	1.75
FCH-PRS-9090	650 MHz ECL/TTL Prescaler	20.90

BOOKS

FCH-BUK-DECL	The ECL Handbook	5.75
FCH-BUK-DLIN	Linear Integrated Circuits Data Book	5.75
FCH-BUK-DMOS	MOS/CCD Data Book	5.75
FCH-BUK-DFUL	Full Line Condensed Catalog	3.45
FCH-BUK-DPOW	Power Data Book	3.00
FCH-BUK-DLOW	Low Power Schottky & Macrologic	3.45

More IMSAI

SOCKET SETS

Order sets SOC-MPU-A and SOC-CP-A for an I-8080

CP-A board (front panel)

\$11 kit
Cat. No. IMS-PTS-SCPAK
\$16 assembled
Cat. No. IMS-PTS-SCPAA

MPU-A board (processor board)

\$8 kit
Cat. No. IMS-PTS-SMPUAK
\$12 assembled
Cat. No. IMS-PTS-SMPUAA

RAM 4A-4 board (memory)

\$22 kit
Cat. No. IMS-PTS-SR4A4K
\$33 assembled
Cat. No. IMS-PTS-SR4A4A

PIC-8 board

\$6 kit
Cat. No. IMS-PTS-SPIC8K
\$10 assembled
Cat. No. IMS-PTS-SPIC8A

PIO 4-4 board

\$11 kit
Cat. No. IMS-PTS-SPO44K
\$17 assembled
Cat. No. IMS-PTS-SPO44A

SIO 2-2 board

\$12 kit
Cat. No. IMS-PTS-SSO22K
\$18 assembled
Cat. No. IMS-PTS-SSO22A

PROM 4-4 board

\$4 kit
Cat. No. IMS-PTS-SP44K
\$6 assembled
Cat. No. IMS-PTS-SP44A

SIOC board

\$3 kit
Cat. No. IMS-PTS-SSIOCK
\$5 assembled
Cat. No. IMS-PTS-SSIOCA

MIO board

\$24 kit
Cat. No. IMS-PTS-SMIOK
\$36 assembled
Cat. No. IMS-PTS-SMIOA

PIO 6-6 board

\$9 kit
Cat. No. IMS-PTS-SPO66K
\$14 assembled
Cat. No. IMS-PTS-SPO66A

INTELLIGENT BREADBOARDS

Complete Breadboard Console BBC-5

\$435 kit
Cat. No. IMS-PTS-BBC5K

\$625 assembled
Cat. No. IMS-PTS-BBC5A

Requires a PIO6-6, two CABLE R's and one CABLE S.

Smaller Breadboard Console BBC-3

\$325 kit
Cat. No. IMS-PTS-BBC3K

\$523 assembled
Cat. No. IMS-PTS-BBC3A

Breadboard Expansion Module BBCM

\$135 kit
Cat. No. IMS-PTS-BBCMK

\$155 assembled
Cat. No. IMS-PTS-BBCMA

Expansion Module to convert a BBC-3 to a BBC-5

Test Plug BBS-Test Plug

\$169 kit
Cat. No. IMS-PTS-BBSTPK

\$279 assembled
Cat. No. IMS-PTS-BBSTPA

LSI-11

—compatible components from DEC
MDB, and Monolithic Systems plus selected refurbished
peripherals from our stock.

LSI-11

CENTRAL PROCESSOR

SALE!

with 4Kx16 Random Access
Memory, 16 bit I/O port
(DMA port).

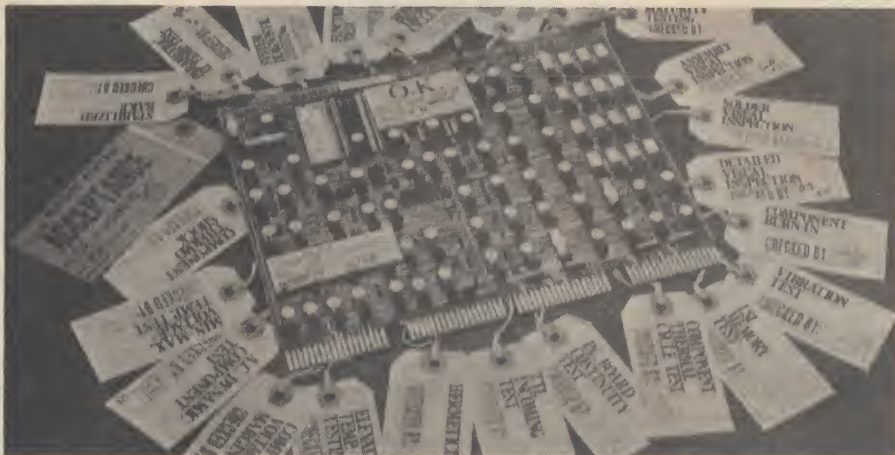
DEC LIST \$990.00

Net 30 price

\$891.00

CASH PRICE

\$801.



Cat. No.	Description	List Price	NCE Price
MICROCOMPUTER MODULES & OPTIONS			
KD11-F LSI-11 CENTRAL PROCESSOR UNIT with 4Kx16 Random Access Memory (RAM), power fail/auto restart, 16-bit I/O port (DMA port), real-time clock input, vector interrupt handling. Board size: 8.5"x10" (21.6x25.4 cm).		\$ 990	\$891
KD11-J LSI-11 CENTRAL PROCESSOR UNIT with 4Kx16 core memory, power fail/auto restart, 16-bit I/O port (DMA port), real-time clock input, vector interrupt handling. Board size: Two 8.5"x10" (21.6x25.4 cm).		\$1536	\$1460
KD11-R LSI-11 Central Processor Unit with 16K x 16 Random Access Memory (RAM), power fail/auto restart, 16-bit I/O port (MDA port), real-time clock input, vector interrupt handling. Board size: Two 8.5" x 10" (21.6 x 25.4 cm).		\$2490	\$2366
KEV11 EXTENDED ARITHMETIC OPTION Includes fixed and floating point instructions.		\$ 190	\$ 181
MLSI-KW11-P PROGRAMMABLE REAL TIME CLOCK. Basic LSI-11 bus interface. Programmable selectable inputs of 100 KHz, 10KHz, line frequency or external signal. By MDB.			\$ 428

LSI-11 Terminal Package

SALE!

Includes

- **DEC LT33 TELETYPE**
Printer, reader, punch, keyboard
(used-refurbished)
- **DEC DLV11** (Serial interface unit)
(new)
- **DEC BC05M-2C**
Input/output cable connector (new)

All assembled and tested. Ready to go.

DEC List \$2,125

\$1,095.00
prepaid price

\$1,225.00
Net 30 price



How quick is quick? We are committed to giving off the shelf deliveries on most items. The tremendous demand for the LSI-11™, with its attendant delivery stretchout, has made this impossible to date. We have placed orders for an extra 3 months supply. Starting in August, deliveries should mostly be from stock, barring additional delivery stretchouts. In the meantime, we do have equipment scheduled and we will generally be able to give better delivery than the manufacturer, if not from stock. Call for a delivery quotation.

EXPANSION MEMORIES

	List Price	NCE Price
MSV11-B 4Kx16 DYNAMIC RANDOM ACCESS MEMORY (RAM). Board size: 8.5"x5" (21.6x12.7cm).	\$ 625	\$ 594
MSV11-CD 16K x 16 Dynamic Random Memory. Board size: 8.5" x 10".	\$1800	\$1710
MMV11-A 4Kx16 CORE MEMORY. Board size: 8.5"x10"x1" (21.6x25.4x2.5 cm).	\$ 990	\$ 941
MRV11-AA PROM/ROM MEMORY UNIT. 32 IC pockets. Accepts 256x4 or 512x4 fusible link memory devices and masked ROM devices. Maximum capacity 4Kx16.	\$ 175	\$ 166
MLSI-MRV-XX E-PROM/PROM/ROM MEMORY MODULE. Basic LSI-11 bus interface. Accommodates E-PROM as well as PROM & ROM. Contact us for more information. Price does not include memory. By MDB.	---	\$ 143
MRV11-AC UNPROGRAMMED FUSIBLE LINK. PROM CHIP (512x4 array size).	\$ 40	\$ 38

COMMUNICATIONS OPTIONS

DRV11 PARALLEL LINE INTERFACE UNIT. 16-bit diode-clamped input; 16-bit latched-drive output. Protocol and control signals. Requires cable. Board size: 8.5"x5".	\$ 210	\$ 200
DRV11-B PARALLEL LINE DMA INTERFACE UNIT. Single-cycle rate: 250K words/sec. Protocol and control signals. Requires cable. Board size: 8.5"x10".	\$ 580	\$ 551
DRV11-P LSI-11 BUS INTERFACE FOUNDATION MODULE. Preassembled bus interface logic and wire-wrapped area for custom interfaces. Capacity: up to 60 14-pin IC's. Requires cable. Board size: 8.5"x10".	\$ 275	\$ 261
DLV11 SERIAL INTERFACE UNIT. Optically-isolated 20mA current loop or EIA interface levels. Selectable stop and data bits; baud rates from 50-9600. Requires cable. Board size: 8.5"x5".	\$ 250	\$ 238
MLSI-DUV11 SYNCHRONOUS SINGLE LINE INTERFACE. Basic LSI-11 bus interface. Full/half duplex synchronous interface. Programmable character sizes, transmission speeds up to 9600 baud, space character. Interfaces to Bell 200 series modem	---	\$ 736
MLSI-1710 GENERAL PURPOSE INTERFACE MODULE. Basic LSI-11 bus interface. Address decode circuitry. Multiple interrupt vector priority selection. Up to 20 user IC positions for wirewrap. Will accommodate any .300, .400 or .600" center dual in-line packages. Multiple external I/O connectors mounted on module. Dual module (mounts in one-half quad slot). Price includes pins in user wirewrap portion. By MDB.	---	\$ 166
MLSI-11B GENERAL PURPOSE DIRECT MEMORY INTERFACE MODULE. Basic LSI-11 bus interface. Address decode circuitry. Address, word count and data registers. DMA bus control and timing logic. Interrupt vector priority logic. Up to 40 user IC posi-	---	\$ 736

tions for wirewrap. Will accommodate any .300, .400, or .600" center dual in-line packages. Multiple external I/O connectors mounted on module. Quad module (mounts in one quad slot). Includes pins in user wirewrap portion. By MDB.

MLSI-WWB1 UNIVERSAL DUAL WIRE-WRAP MODULE. Space for up to 36 user DIP devices. Pads for discretes at each position. All holes plated through UL approved FR 4 material. Wirewrap pins on component side of module. Multiple external I/O connectors mounted on module. Will accommodate any .300, .400, or .600" center dual in-line packages. Optional sockets available. Dual module (mounts in one-half quad slot). By MDB.

MDB-11WWB UNIVERSAL QUAD WIRE-WRAP MODULE. Space for up to 70 DIP devices. Pads for discretes at each position. All holes plated through, UL approved FR 4 material. Wirewrap pins on component side of module. Multiple external I/O connectors mounted on module. Will accommodate any .300, .400, or .600" center dual in-line packages. Externally cableable to other MDB modules. Optional sockets available. Quad module (mounts in one quad slot). By MDB.

MLSI-DLV11 SERIAL LINE INTERFACE. Fully software compatible with DLV11. DIP switch selectable baud rates. DIP switch selectable UART parameters. All rates, 75 to 19.2K baud with no crystal change. Optically isolated 20 or 60MA current loop. EIA RS232C receivers and drivers available for terminal operation. Multiple serial line address selection standard. By MDB.

PERIPHERAL CONTROLLERS

MLSI-CR11-CA CARD READER CONTROLLER. Basic LSI-11 bus interface. Can be used with most popular card readers including Documentation, Mohawk, & Peripheral Dynamics. Occupies one quad slot. Software transparent. With cable. By MDB.	---	\$ 618
MLSI-LP11 LINE PRINTER CONTROLLER. Parallel interface for all popular line printers. LP-11 software compatible. Dual module (mounts in one-half quad slot). Multiple line printer address selection standard. 15 foot cable with printer mating connector standard. By MDB.	---	\$ 428
MLSI-PC11B PAPER TAPE READER/PUNCH CONTROLLER. Parallel interface for all popular paper tape readers and punches. PC11 software compatible. Dual module (mounts in one-half quad slot). Multiple address selection standard. 15 foot cables with mating connectors standard. By MDB.	---	\$ 523
MLSI-PC11P PUNCH CONTROLLER only. By MDB.	---	\$ 428
MLSI-PC11R READER CONTROLLER only. By MDB.	---	\$ 428

Peripherals

	List Price	NCE Price
RXV11-AA SINGLE DRIVE FLOPPY DISK WITH INTERFACE. 256K byte capacity.	\$3350	\$3183
RXV11-BA DUAL DRIVE FLOPPY DISK WITH INTERFACE. 512 byte capacity.	\$4300	\$4085

ACCESSORIES AND OPTIONS

H9270 BACKPLANE/CARD GUIDE ASSEMBLY. Prewired for LSI-11 bus to accept one microcomputer and up to six I/O and /or memory modules.

\$ 190 \$ 181

H9271 BACKPLANE/CARD GUIDE ASSEMBLY. Unwired version of H9270.

\$ 94 \$ 89

Note: When assembling multi-backplane LSI-11 or PDP-11/03 systems, a BCV1B jumper cable/terminator assembly and terminator module (TEV11) are necessary. If expanding to a third backplane, one BCV1A-XX jumper cable is needed. At least a 4-foot length difference must be maintained between the BCV1A-XX and the BCV1B-XX to prevent bus signal reflection.

BA11-ME EXPANDER BOX which includes the H9270 backplane and power supply. Dimensions: 19"x13.5"x3.5" (48.3x34.3x8.9 cm).

\$1000 \$ 950

H780-C Power Supply, No Console. 115V

\$ 650 \$ 618

H780-K Power Supply, Slave Console. 115V

\$ 675 \$ 642

H780-H Power Supply, Master Console. 115V

\$ 700 \$ 665

DDV11-B BACKPLANE WITH PREWIRED LSI-11 BUS (without card guide) designed to accept one microcomputer and up to 16 I/O and/or memory modules. An additional nine unwired slots are also available. *Requires* a TEV11 or REV11 terminator.

\$ 400 \$ 380

H0341 CARD GUIDE ASSEMBLY for DD11-B backplane.

\$ 39 \$ 37

H909-C EXPANDER BOX including H0341 card guide and space for DDV11-B and power supply.

\$ 450 \$ 428

TEV11 LSI-11 BUS TERMINATOR MODULE used in multiple backplane configurations. Board size: 8.5"x5".

\$ 100 \$ 95

REV11-A REFRESH/BOOTSTRAP/DIAGNOSTIC/TERMINATOR OPTION. External refresh module which is used when the dynamic RAM memory refresh implemented in the LSI-11 or PDP-11/03 CPU microcode is disabled. included are bootstraps for the RXV11 floppy disk, resident paper tape absolute loader. CPU and memory diagnostics, and 120 ohm bus termination.

\$ 320 \$ 304

REV11-C REFRESH/BOOTSTRAP/DIAGNOSTIC OPTION. (For use with high-speed DMA devices - see Configuration Guide)

\$ 320 \$ 304

BCV1A-02 JUMPER CABLE/TERMINATOR ASSEMBLY. This is used to expand the backplane from the second to the third backplane. Consists of two 8.5"x5" double height modules interconnected by a 2, 4, 6, or

\$ 210 \$ 200

10-foot 40-conductor Berg to Berg connector cable. BCV1A-04, BCV1A-06, BCV1A-10.

List Price NCE Price

BCV1B-02 JUMPER CABLE/TERMINATOR ASSEMBLY. This is used to expand the backplane from the first to second backplane. Consists of two 8.5"x5" double height modules interconnected by a 2, 4, 6, or 10-foot, 40-conductor Berg to Berg connector cable. BCV1B-04, BCV1B-06, BCV1B-10.

\$ 290 \$ 276

BC05C-25 INPUT/OUTPUT CABLE CONNECTOR. Used with DLV11 for EIA-level. Approximately 25 feet (7.6m) long.

\$ 112 \$ 106

BC05M-1F INPUT/OUTPUT CABLE CONNECTOR. Used with DLV11 for 20-mA current loop applications. 1.5 feet (45.7 cm) long.

\$ 45 \$ 43

BC05M-2C Power Supply. Length 2 ft. 3 in.

\$ 44 \$ 42

MDB-BC05M-2C Cable Connector for 20mA current loop (2 ft) by MDB.

— \$ 29

MDB-BC05C-25 Cable Connector for EIA (25 ft.) (Asynchronous) By MDB.

— \$ 81

MDB-DB05C-25 Cable Connector for EIA (25 ft.) (Synchronous) By MDB.

— \$ 81

BC08R-0I DRV11 MAINTENANCE CABLE. Connects input and output ports for use with diagnostic software.

\$ 50 \$ 48

BC04Z-10 40-CONDUCTOR FLAT RIBBON CABLE with Berg connector at one end and open at the other for use with all DRV11 interfaces. 10, 15, and 25 feet (3.05m, 4.5m, and 7.6m) long.

\$ 53 \$ 50

BC04Z-15 LENGTH 15 FEET.

\$ 63 \$ 60

BC04Z-25 LENGTH 25 FEET.

\$ 89 \$ 85

H984 TABLE-TOP CABINET FOR PDP-11/03. Includes rollers, 19-inch mounting space, walnut top, and power distribution. 26"Hx28"Dx21.5"W.

\$ 390 \$ 371

SOFTWARE PACKAGES AVAILABLE FOR THE LSI-11

Note: All software products listed are furnished under license for use on a single LSI-11 microcomputer module and may be copied (including Digital's copyright notice) only for use in that computer. We suggest ordering directly from DEC.

ZJV01-RB LSI-11 PAPER TAPE DIAGNOSTICS. Tests processor, exercises memory, isolates problem modules, exercises I/O devices. Minimum hardware 4K LSI-11 or 11/03.

\$ 120 \$ 150

ZJ215-RY LSI-11, 11/03, 11V03 DIAGNOSTICS ON FLOPPY DISK. Minimum hardware: 4K LSI-11, 11/03, or 16K 11V03.

\$ 300 \$ 375

QJV10-CB PTS-11 PAPER TAPE SYSTEM. A collection of stand alone programs including - ED-11 Editor, PALS Assembler, LINK-11S Absolute Loader, ODT-11X debugging tool, IOX Dump-AB. Minimum hardware: 8K LSI-11 or 11/03 and ASR33 teletype. Support category C, license without service.

\$ 110 \$ 138

10% DISCOUNT ON ALL PREPAID ORDERS OF LSI-11 EQUIPMENT

	List Price	NCE Price
QJV11-CB PROM FORMATTER SOFTWARE. This software generates correctly formatted tape from which a PROM chip can be blasted. Compatible with many manufacturers' PROM loaders. Minimum hardware: 4K LSI-11 or 11/03. Support category C	\$ 30	\$ 38
QJ003-AY RT-11 REAL-TIME OPERATING SYSTEM (version 2C) designed for the single user includes single job monitor as well as Foreground/Background monitor. RT-11 system programs include EDIT, MACRO-11, LINKER, PIP, LIBRARIAN, ODT, and Utilities. Minimum hardware: 8K LSI-11 or 16K LSI-11 for foreground/background RXV 11 floppy disk, console terminal. Support category A, license with service.	\$1380	\$1311
QJ920-AY BASIC/RT-11. A single-user Dartmouth Standard BASIC language processor implemented under the RT-11 Real-time Operating System. Prerequisite- license to use RT-11(QJ003-AY). Support Category A	\$ 830	\$ 789
QJ921-AY MULTI-USER BASIC/RT-11. 1-8 users. Ability to run either foreground/background concurrently with other jobs. Support category A	\$ 830	\$ 789
QJ922-AY FOCAL/RT-11. Simple, yet powerful language processor running under RT-11. Prerequisite: license to use RT-11 (QJ003-AY). Support category A	\$ 370	\$ 352
QJ925-AY FORTRAN/RT. Extended super-set of the ANSI standard FORTRAN IV language running under RT-11. Prerequisite: license to use RT-11 (QJ003-AY). Support category A,	\$ 880	\$ 836
QJ945-AY REMOTE/RT-11 Scientific Subroutine Package for FORTRAN/RT-11. Prerequisites: license to use RT-11. Support Category A.	\$1100	\$1045
QJ960-AY SSP-11RT-11 Scientific Subroutine Package for FORTRAN/RT-11. Prerequisites: licenses to use RT-11 and FORTRAN/RT-11.	\$ 370	\$ 352
QJ640-AY RSX-11S OPERATING SYSTEM (Version 1). RSX-11S provides a run-time environment for execution of tasks which have been generated by an RSX-11M or RSX-11D development system. Minimum hardware: 8K LSI-11 or 11/03, RXV11 floppy disk (load media), line-time clock Category A.	\$1650	\$1568

SOFTWARE PRODUCT LICENSE

LSI-11 software provided hereunder, including any subsequent improvements or updates, is furnished to Customer under a license for use on a single micro-computer ("Unit") and may only be copied, in whole or in part, (with the inclusion of DIGITAL's copyright notice) for use on such Unit. Customer shall not provide or otherwise make available the software or any part thereof in any form to any third party, except that Customer may provide software to a third party to whom Customer transfers a Unit, provided that such third party agrees: (1) to limit the use of the software to the Unit transferred by Customer to the third party; (2) to only copy the software, in whole or in part (with the inclusion of DIGITAL's copyright notice), for use on such Unit; and (3) not to provide or otherwise make available the software to any other person. Title to and ownership of the software and any unmodified parts thereof shall at all times remain with DIGITAL.

WARRANTY

All items warranted for 90 days unless otherwise specified. Return any defective unit to us during warranty and we will repair or replace it without charge.

Substitution and Modifications of Specification

NCE reserves the right to make substitution and modifications in the specification of the Products, providing that such substitutions or modifications will not materially degrade the performance of the Products.

NOTE:

NCE assumes no responsibility for any errors which may appear in this catalog.

Price and availability subject to change without notice.

This catalog supercedes all previous published plans and prices.

All items new and manufactured by DEC with new DEC warranty, unless otherwise noted.

10% OFF FOR CASH!

SALE!

LSI-11 Card Reader Package

Includes

- **DOCUMENTATION M200 CARD READER**
285 cpm (used-refurbished)



- **CARD READER CONTROLLER**
Basic LSI-11 bus interface. Mounts in one quad slot. Software transparent. With cable.

\$1,845.00
prepaid price

\$2,050.00
net 30 price

SALE!

LSI-11 Printer Package

Includes

- **CENTRONICS 101 SERIAL PRINTER**
165 C.P.S., 132 print positions. Adjustable sprocket feed. Vertical form feed. Completely refurbished and repainted.
- **MDB CONTROLLER & CABLE**
LP-11 software compatible. Mounts in 1/2 quad slot. 15 ft. cable with printer mating connector standard.

\$2,025.00
prepaid price

\$2,250.00
net 30 price

Send for our FREE! Getting Started with Microcomputers

We had intended to devote a significant portion of this catalog to the subject of getting started with personal computing in your home or business. Two things interfered with that intention; the exploding number of exciting new products we wanted to include in our limited catalog space and our inability to shrink ever-

thing we had to say on the subject to a few pages. As a result we decided to publish a separate 8-page booklet called *Getting Started with Microcomputers*.

To get your free copy fill out the NCE Action Request (in the center fold). No order is necessary. This booklet is

filled with all sorts of useful information. We have tried to avoid academic analysis and have included practical recommendations. Money saving packages are offered for both the pre-user and user of personal computers.

Sample Table from *Getting Started with Microcomputers*

Phase			"This is great, now I want a complete computing system. (15 years ago a system like this would have cost \$400,000.)"	"I'm ready for those advanced personal, business or professional applications that really pay off."
Electronics Experience	"What's the microcomputer all about—can it benefit me or my family?"	"OK, let's try an inexpensive system to see how I like it."		
None	You can start at any of the phases represented by the four different Columns. For the cautious or those on severely restricted budgets we recommend starting at this phase. No matter where you start, you'll want to have this basic library. PCC's Reference Book of Personal & Home Computing The <i>Reference Book</i> contains a huge amount of simply invaluable reference material on sources of equipment, services, software; on clubs, magazines, books—most everything you need to know about this new field. All of this is supplemented by articles describing personal and home computing in all its multifaceted areas and where the whole field is going. PCC's What to Do after You Hit Return Includes number, word, pattern and board games and life simulations. Contains program listings, instructions, and examples. Microcomputer Primer Waite and Pardee Covers the common characteristics of microcomputers. An excellent introduction to just what a microcomputer is and how it works. Basic BASIC: An Introduction to Computer Programming in BASIC Language Coan A text for high school and college level. An excellent introduction to the language you will most probably use with your microcomputer. Purchased individually \$28.80 SALE price \$25.50 Cat. No. PKG-BUK-0001	We are recommending 2 starter systems. Both are foolproof, proven, will work the day you get them (when purchased assembled), and outstanding values. These are our most popular machines and we have sale priced them to make them even more popular. KIM system from MOS Technology. See page 40 for more information. Sale package includes: KIM-1 Computer Module System Power Supply System Executive Software (stored in 2048 ROM bytes) KIM-1 User Manual KIM-1 System Schematic, wall size 6500 Hardware Manual 6500 Programming Manual 6500 Programmer's Reference Card Cassette recorder selected for KIM-1 Cassette recorder interface cable PLEASE collection of computer programs CHESS computer program for KIM-1 Purchased individually \$385.00 SALE price \$349.00 Cat. No. PKG-KIM-0001 For those willing to start with a small memory, machine language programming, and limited upgrade capability, the KIM system is an exceptional value. These limitations should disappear in late summer when NCE/CompuMart offers an expansion package for the KIM-1. Meanwhile you get an extremely fast computer with features not found in more expensive systems.	For KIM owners: We are currently evaluating several alternative system for economically adding to the KIM-1 — additional memory, disks, all the other system components you could ever want. Our selection should be ready for sale in July. Contact us for further details. For Poly88 owners: All you need for your Poly88 is a floppy disk (see page 42), more memory (see page 63) and perhaps a printer. Contact us with a description of your application and we would be happy to recommend an appropriate printer. As indicated, the Poly88 can accommodate S-100 boards and peripherals.	The possibilities are endless. We would be happy to discuss your application with you and make recommendations. - Processing power can be increased with auxiliary processor. - Memory can be expanded with more semiconductor memory, hard disks & magnetic tapes. - Data can be obtained through paper tape readers, joysticks, digitizers, audio recognition devices, card readers, optical wand readers, optical character readers, through analog to digital converters, physical properties such as temperature, pressure, light and moisture can be sensed. - Your personal computer can communicate through printers, plotters, graphic displays, lights, audio response devices, and through converter relays, motors, switches, valves, etc., etc.
Some, but little computer experience	PCC's Reference Book of Personal & Home Computing PCC's What to Do after You Hit Return Introduction to Microcomputers, Vol. 1 Osborne Over 30,000 copies sold in its first 5 months. The best seller in the field. How to Buy & Use Minicomputers & Microcomputers Barden How to select and buy, as well as profiles on the popular brand minis & micros. A good start for companion shopping if you are considering purchase. Sam's Computer Dictionary (2nd Edition) The most comprehensive reference available on all phases of computers and their applications: over 22,000 definitions, acronyms, and abbreviations. Purchased individually \$38.85 SALE price \$35.00 Cat. No. PKG-BUK-0002	Poly88 System from PolyMorphic Systems. See page 65 for more information Compatible with the S100 industry standard, this system fully implements the BASIC language. You need not have learn all the inner workings of computers to use our Poly88. Also available as a kit for individuals with troubleshooting capability. System 7: Consists of an assembled and tested Poly88 with 8K of memory, keyboard, TV monitor, cassette recorder, 8K BASIC, and Assembler cassette tapes. Purchased individually \$1,860.00 SALE price \$1,695.00 Cat. No. POL-PKG-SYS7A System 3: System 7 purchased in kit form. Purchased individually \$1,460.00 SALE price \$1,295.00 Cat. No. POL-PKG-SYS7K		
Can write computer programs or design computer interfaces.	PCC's Reference Book of Personal & Home Computing, How to Buy & Use Minicomputers and Microcomputers Barden Sam's Computer Dictionary (2nd Edition) Introduction to Microcomputers, Vol. 1 Osborne Introduction to Microcomputers, Vol. 2 Osborne Picks up where Vol. 1 leaves off & goes into detail on today's real products, more detail than most manufacturers provide. Microprocessor Basics Edited by Elphick This book provides detailed coverage of the popular models: 8080, 6800, F9, PACE, IMP, 2650, 1802, and 6100. Includes architecture, advantages and disadvantages, capabilities, and the very latest applications. Purchased individually \$54.30 SALE price \$49.00 Cat. No. PKG-BUK-0003			

Remember, the complete booklet *Getting Started with Microcomputers* is FREE. Fill our NCE Action Request on the centerfold to get your copy.

IMSAI The Cadillac of Microcomputers



IMSAI 8080 THE PROFESSIONAL, AFFORDABLE COMPUTER SYSTEM

Here's a high-quality microprocessor-based system that gives you the performance and flexibility you demand at a price you can afford. Whether you're a cost/performance-conscious OEM, or an uncompromising experimenter, IMSAI 8080 should be your affordable choice.

The computer, using Intel's 8080A chip, makes up to 64K words (bytes) of memory directly accessible. With a basic machine cycle of 0.5 microsecond, and with as many as 256 I/O ports directly accessible, this is definitely a high-capability machine.

The computer is backed by a family of options and peripheral devices and interfaces to do just about any job... serial and line printers, a video terminal, tape cassette, disk or teletypewriter.

It's modular, so you can easily add to your IMSAI 8080 system.

Basic software furnished includes a resident monitor, assembler, text editor, loader and debugger. There's a wide range of high-level system software available to registered IMSAI 8080 owners at very low cost.

While the computer is designed as a high-quality commercial computer, there's no compromise in quality or value if you purchase it as a kit. You can get it together and bring it up in 10 to 20 hours, depending on your experience. Plug-in modularity minimizes solder connections to speed assembly and enhance reliability.

NEW IMSAI Memory Explosion and NCE has it!

As low as
\$449
for a 16K
Memory Board

The Megabyte Micro™

- a full megabyte of power from 16 65K RAM boards
- controlled by the IMSAI Intelligent Memory Manager (IMM)-the super control board
- can write protect blocks throughout the full megabyte; or map in 16K blocks
- preset 16 mapping configurations with protect for high speed transfer or rapid change
- fully vectored interrupts; interrupt for attempt to write in protected memory
- real "time of day" clock
- can be used in any S-100 bus computer
- fast-"hidden refresh" and no "wait state"

16K RAM Board \$449 kit

Cat. No. IMS-MEM-16KRBK

32K RAM Board \$749 kit

Cat. No. IMS-MEM-32KRBK

65K RAM Board \$2,599 kit

Cat. No. IMS-MEM-65KRBK

IMM ROM Control \$299 kit

Cat. No. IMS-IOX-IMMRK

IMM EROM Control \$499 kit

Cat. No. IMS-IOX-IMMEK

\$679 assembled

Cat. No. IMS-MEM-16KRBA

\$1,099 assembled

Cat. No. IMS-MEM-32KRBA

\$3,899 assembled

Cat. NO. IMS-MEM-65KRBA

\$399 assembled

Cat. No. IMS-IOX-IMMRA

\$699 assembled

Cat. No. IMS-IOX-IMMEA

Your IMSAI 8080 computer will be supported by complete documentation including:

- IMSAI 8080 System User's Manual
- Intel 8080 Microprocessor System User's Manual, describing the Intel devices and instruction set
- An Introduction to Microcomputers, textbook on the programming and architecture of microcomputer systems

Your computer is backed by a 90-day warranty, and full factory service at moderate cost.

Whether your IMSAI 8080 computer is to be used up-front, or hidden in your dedicated application, you'll find it the right system to start with, and the best to grow with.

OUTSTANDING HARDWARE FEATURES

Front Panel

- Handsome and functional, with sharp, readable legends behind acrylic panel
- All indicators long-life LED's . . . panel filter enhances contrast
- Eight extra LED's programmed as an output port
- Easy-to-use paddle handle switches
- Easily customized for private labeling

Mechanical

- Sturdy card-cage construction . . . holds up to 22 cards
- Straight-through backplane design . . . no special-purpose slots
- Short backplane sections available
- Flat cable interconnections throughout
- Absolute minimum of point-to-point wiring . . . no point-to-point wiring to front panel permits easy panel removal
- Rack-mount cabinet available
- Pc boards double-sided with plated-through holes and solder mask
- Pc boards of glass-fiber reinforced epoxy laminate
- Pc board contact fingers gold-plated over nickel

Electrical

- Front panel circuits make one-shot timing links non-critical
- Latest LSI and MSI components . . . minimizes package count
- Heavy-current tri-state bus drivers

Power Supply

- Heavy-duty supply . . . 28 amperes for system expansion
- Power regulated on-board by IC devices with thermal current limits
- Generous ceramic disk power decoupling capacitors . . . dipped tantalum capacitors for board decoupling

System

- Designed from the beginning for multi-processor, shared memory capability

- Software drivers available for all IMSAI 8080 peripherals

SPECIFICATIONS

Processor Intel 8080A

Memory (directly addressable): 65,536 words
 Word Size: One byte (8 bits)
 Register Instruction Cycle Time: 2 microseconds
 Basic Machine Cycle Time: 0.5 microsecond
 Number of Input/Output Ports: 256
 Machine Instruction Set: 78 basic instructions, 174 including variants
 Nested Subroutine Calls: Number limited only by memory size
 Interrupts: Eight hardware levels (with optional PIC-8 board)
 Registers: Six plus stack pointer, program counter, accumulator and status register
 Memory Type: Semiconductor (1K x 1 bit chips)

Cabinet

Custom aluminum case with acrylic front panel
 Dimensions: 19½ in. wide, 17 in. deep, 7 in. high (rack mount option available)
 Front Panel Switches: Paddle handle

Power

Requirements: 120V, 50-60 Hz, single phase, less than 50 Watts (basic system)
 Maximum Power Capability: Up to 500 Watts in a large system

Interconnections

Back panel accommodates ten EIA-type 25-pin connectors. Opening and cable clamp furnished for flat cables to exit from cabinet. Flat cables used throughout.

CHOOSE FROM ONE OF THE BASIC IMSAI 8080 MICROCOMPUTER SYSTEMS

* I-8080

\$699 kit
 Cat. No. IMS-CPU-8080K

\$931 assembled
 Cat. No. IMS-CPU-8080A

The standard microcomputer includes:

- Front panel and control board (CP-A)
- Chassis with 22-slot card cage
- Sturdy, attractive dust cover (DC)
- Microprocessor board (MPU-A)
- 28-ampere power supply (PS-28)
- Mother Board with six board slots
- Two 100-pin edge connectors with card edge guides (EXPM)
- IMSAI 8080 System User's Manual
- Intel 8080 Microprocessor System User's Manual
- An Introduction to Microcomputers

- Software including monitor, assembler, editor, loader and debugger (punched paper tape and source listings)

Mother Board

Card-to-card spacing on the Mother Board is ¾-inch, except for the first position reserved for the front panel board or any other board in dedicated applications.

Additional four-slot Mother Board sections (EXP-4) may be added to accommodate connectors, and are connected to other Mother Board sections by jumpers between through-plated holes. A full-length, 22-slot Mother Board (EXP-22) is also available and may be ordered initially in place of the six-slot board.

Heavy power traces handle the large currents that exist in a heavily loaded backplane. High-quality connectors have gold-plated contacts for reliability and long life.

Front Panel

The CP-A Board forms the operator's panel. It includes switches, indicators and logic needed for manual operation. The panel is completely self-contained and plugs directly into the first Mother Board slot. Or it may be connected through an extender board to any available slot in the Mother Board. When the first slot is not used for the front panel, that slot may be used by another board, such as the Parallel I/O Board with its LED indicators visible.

Front panel facilities include:

- 16 address/data switches
- 16 LED address indicators
- 8 LED data bus indicators
- 8 LED programmed output bit indicators
- 6 control function switches
- 8 LED status indicators (including control indicators for INTERRUPT ENABLED, RUN, WAIT and HOLD)

The front panel includes logic that drives the programmed output indicators, and reads the input byte from the high-order address switches. DATA BUS indicators show data either read or written by the processor.

Indicators are wide-angle LED's behind a contrast-enhancing acrylic panel assembly. Photographically produced panel markings are crisp and explicit and can never wear off. Bit positions are numbered and labeled for both hexadecimal and octal notation. Special labels may be easily inserted to identify special functions for the programmed output LED's.

Switches are high-quality units, with paddle handles color-coded for easy, error-free operation.

Power Supply

The Power Supply (PS-28) is designed for use with pc boards having on-board regulators. Outputs are +10V and $\pm 18V$ at no load, and approximately +7V and $\pm 15.8V$ at full load.

A Power Supply pc board contains rectifiers and 120V ac switching and fusing functions. The board provides terminals for switched ac power, both fused and unfused, for a ventilating fan and auxiliary power outlets on the back panel. When the computer is supplied without the front panel, an ac power switch is mounted on the Power Supply Board.

A custom-built transformer and large, conservatively rated filter capacitors are mounted on the chassis.

Processor Board

The Processor Board (MPU-A) contains the Intel 8080A Microprocessor chip, clock crystal oscillator and clock drivers, status signal latches and bidirectional bus drivers, as well as on-board power supply voltage regulators.

The bus arrangement and board connector are designed so that the MPU-A board may be used directly in the MITS Altair M8800 Microcomputer system.

The 2-MHz, 2-phase non-overlapping clock for the processor chip is provided by an 18-MHz crystal and 8224 clock driver. An 8212 chip latches status signals. Two 8216 tri-state, bidirectional bus drivers interface the processor chip with the IMSAI 8080 data buses. Other tri-state bus drivers drive address, status and control lines.

The MPU-A board receives $\pm 16V$ and +8V supply voltages and uses on-board regulators to obtain required voltage levels.

The board edge connector has 100 pins on 0.125-inch centers, with 50 pins on each side. Except for gold-plated contact fingers, circuit traces are tin-lead plated for easier, more reliable solder connections.

The board includes a power-on reset circuit, plus pull-up resistors so that without the front panel, power-on reset will start the program at location zero.

Multiple microprocessor boards are able to share memory and run identical or different programs in parallel.

I-8080-OEM

\$629 kit

Cat. No. IMS-CPU-8080OK

\$749 assembled

Cat. No. IMS-CPU-8080OA

Basic I-8080 system computer less front panel. Power on/off switch is provided.

YOUR CHOICE OF OPTIONS AND COMPONENTS FOR THE BASIC SYSTEM

Rack Mount RM

\$20

Cat. No. IMS-PTS-RM

This hardware lets you mount the computer chassis in a standard 19-inch electronics rack. It consists of side panels that bolt to the inner sides of the cabinet and support the chassis. A special dust cover is provided in place of the standard dust cover, as well as a modified front panel sheet metal escutcheon. This option must be ordered in conjunction with the basic computer system.

22-Slot Mother Board EXP-22

\$52 ordered with kit

\$65 ordered without kit

Cat. No. IMS-PTS-EXP22K

\$62 ordered with assembled CPU

\$65 ordered without assembled CPU

Cat. No. IMS-PTS-EXP22A

Twenty-two-slot Mother Board replaces all other Mother Board sections in the computer, offering maximum expansion capability. Reduced price available if ordered with basic system. Edge connectors must be ordered separately.

4-Slot Mother Board Expander EXP-4

\$18 kit

Cat. No. IMS-PTS-EXP4K

\$28 assembled

Cat. No. IMS-PTS-EXP4A

Four-slot Mother Board Expander to increase the number of available slots beyond the six-slot board in the basic system. Bus lines must be wire-jumpered and soldered to existing Mother Board sections. Computer will accommodate up to four EXP-4 boards. Edge connectors must be ordered separately.

Edge Connector EXPM

\$7 kit

Cat. No. IMS-PTS-EXPMK

\$15 assembled

Cat. No. IMS-PTS-EXPLA

Connects a pc board in the computer to the Mother Board. Consists of a 100-pin edge connector to be soldered to Mother Board, plus two card-edge guides that attach to side of the card cage. Extra edge connectors may be ordered with the basic system to permit easy future expansion.

Priority Interrupt/Interval Clock Board PIC-8

\$125 kit

Cat. No. IMS-IOX-PIC8K

\$238 assembled

Cat. No. IMS-IOX-PIC8A

The PIC-8 board lets your processor perform jobs between interrupts, without the need to continually poll devices to see if any require service.

Priority interrupt logic on this board monitors the eight priority interrupt lines on the computer Mother Board.

It can service either single or multiple interrupt requests. When enabled and it receives an interrupt request, the PIC-8 determines if the request priority is higher than the software-controlled present priority and, if it is, issues a restart instruction that directs the system to the appropriate one of eight priority-controlled restart locations.

For multiple interrupt requests, the PIC-8 determines the highest-priority request and processes it normally.

Note that the system does not store inactive requests, and that a peripheral device must hold its interrupt request until it is acknowledged by the microprocessor.

The present-priority status register may be set by software to any desired value to prevent generation of low-priority interrupts until the register is reset to a lower value. The status register may be set to permit all levels of interrupt to occur.

The PIC-8 board also includes a clock circuit which generates program-controlled interrupts at intervals preset from 0.1 millisecond to 1 second. Any three rates may be jumper-selected, selecting from rates of 0.1, 0.2, 1.0, 2.0, 10, 20, 100, 200 or 1000 milliseconds. Any one of the three selected rates, or none, may be selected by the program.

One bit of the DATA OUTPUT port is connected to a transistor and jumper pads to provide a special-purpose program-controlled output. The circuit board also provides five 16-pin DIP hole patterns with power and ground decoupling for special circuits of your own design. Hole patterns are drilled for wire-wrap sockets. There is room on the board to mount a small speaker driven by the aforementioned transistor or other circuits of your own design.

An edge connector EXPM is required to install the PIC-8 board.

General Purpose Prototype Board GP-88

\$39 kit

Cat. No. IMS-PTS-GP88K

\$47 assembled

Cat. No. IMS-PTS-GP88A

This board may be used to develop and build your own custom circuits. It offers space for up to 31 16-pin DIP devices and two 40-pin DIP's. Or three 24-pin DIP's may be installed in the two 40-pin spaces. Hole patterns are drilled for wire-wrap sockets.

The board is supplied with an on-board regulator and tantalum decoupling capacitor. An edge connector EXPM is required to install the board.

Extender Board EXT

\$39 kit

Cat. No. IMS-PTS-EXTK

\$49 assembled

Cat. No. IMS-PTS-EXTA

The Extender Board plugs into an edge

*Kit is standard stock item

connector on the Mother Board and is used to extend a functional circuit board out of the card cage for access to circuits. End pins are marked at every fifth pin for fast identification.

Using the Extender Board, the front panel/control board may be attached to any slot in the chassis. Requires edge connector EXPM.

Cooling Fan FM

\$29 kit

Cat. No. IMS-PTS-FMK

\$49 assembled

Cat. No. IMS-PTS-FMA

Muffin-type fan that may be installed at rear of computer chassis. It is recommended when there are 10 or more boards in the chassis.

Front Panel CP-A

\$189 kit

Cat. No. IMS-PTS-CPAK

\$325 assembled

Cat. No. IMS-PTS-CPAA

The standard front panel and control card. Requires edge connector EXPM.

Power Supply PS-28

\$100 kit

Cat. No. IMS-PTS-PS28K

\$179 assembled

Cat. No. IMS-PTS-PS28A

The standard IMSAI 8080 power supply providing 28 amperes at +7V dc minimum, and 3 amperes each at +15.8V and -15.8V minimum. Operates from 120V, 50-60 Hz power.

Dust Cover DC

\$50

Cat. No. IMS-PTS-DC

The standard IMSAI dust cover normally delivered with the IMSAI 8080 computer.

Microprocessor Board MPU-A

\$190 kit

Cat. No. IMS-CPU-MPUAK

\$350 assembled

Cat. No. IMS-CPU-MPUAA

This is the Microprocessor Board that is part of the basic computer. Requires edge connector EXPM.

MEMORIES WITH UNMATCHED PERFORMANCE

*4K Random Access Memory RAM 4A-4

\$139 kit

Cat. No. IMS-MEM-RA4A4K

\$279 assembled

Cat. No. IMS-MEM-RA4A4A

The basic memory is the 4K Random Access Memory (RAM 4A-4). This board stores 4096 bytes of changeable information, either programs or data. Information may come from a computer program, a peripheral device, or the front panel switches.

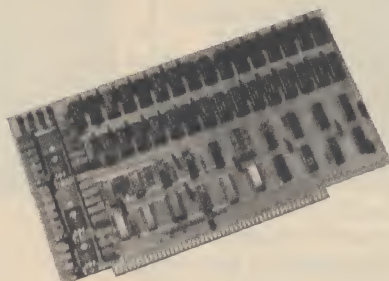
RAM 4A-4 offers a number of unique features to make program development easier. A powerful memory write-

*Kit is standard stock item

protect feature lets you protect 1K-byte blocks of data under program or front panel control. The program can test for the protect status of any 1K-byte block, and an interrupt is generated when a protected block is illegally accessed.

The board has two LED indicators for each 1K-byte block. One is lit when the block is write-protected, and the other is lit when the block is being accessed for reading or writing.

Storage is static using 2102-type chips (no refresh cycle) with a cycle time of 500 nanoseconds. The board address can be jumper-selected to any 4K block of the computer's 64K-byte address space. The memory is fast enough so that no wait cycles are required. If you use slower memory chips a wait cycle can be generated.



Tri-state bus drivers and three fully decoupled on-card voltage regulators are used.

The board also includes a battery backup circuit (battery not included) to save memory contents when ac power is turned off. Each RAM 4A-4 board requires one edge connector (EXPM).

Read Only Memory PROM4-4

\$399 kit

Cat. No. IMS-MEM-P44K

\$579 assembled

Cat. No. IMS-MEM-P44A

This board (PROM 4-4) provides non-volatile program storage that cannot be changed by the computer or erased when power is turned off. Use a PROM board for programs that are run frequently. For example, IMSAI provides the BASIC language in PROM.

The board contains 16 Intel 1702A, or equivalent, EPROM chips in sockets. They may be erased by ultraviolet light and can be reprogrammed electrically by a PROM programmer unit. Each device stores 256 bytes for a total of 4K bytes on the board. Each of the 16 PROM sockets is individually addressable and PROM's operate independent of each other. Thus, memory space may be structured by simply arranging PROM's in appropriate sockets. The board address is jumper-selected to any 4K block of the computer's 64K memory space.

A user-selectable memory-read delay (0 to 3 machine cycles) allows most efficient use of fast or slow PROM chips. The chips supplied have an access

time of 1000 nanoseconds.

The board includes tri-state bus drivers and fully decoupled supply voltage regulators. An EXPM edge connector is required to install the board.

512 Bytes PROM Memory PROM 4-512

\$165 kit

Cat. No. IMS-MEM-P4512K

\$247 assembled

Cat. No. IMS-MEM-P4512A

This is a memory board (PROM 4-512) with only two PROM chips that provide 512 bytes of PROM storage. The board may be fully populated, in 512-byte increments, up to 4K bytes by adding 512 Byte Memory Module (MM702-5) sets. An EXPM edge connector is required.

512 Bytes PROM Memory Module MM702-5

\$50 kit

Cat. No. IMS-MEM-M7025K

\$69 assembled

Cat. No. IMS-MEM-M7025A

This is a set of PROM chips (MM702-5) to add 512 bytes of storage to a PROM 4-512 board.

MULTIPROCESSING AND SHARED MEMORY SYSTEMS

Imesai Shared Memory Systems represent the state of the art in multiple processors operating with a common memory space. Each CPU is connected directly to its own local memory and communicates with the shared memory through the components listed below. The shared memory may be placed on the mother board with the first CPU (the data and address lines must be cut), or in an enclosure with its own mother board and power supply. Up to 65K may be shared between up to 6 CPU's, creating a nearly unlimited number of possible applications.

Shared Memory Switching Board

\$325 kit

Cat. No. IMS-IOX-SMCK

\$399 assembled

Cat. No. IMS-IOX-SMCA

Shared Memory Controller Board

\$225 kit

Cat. No. IMS-IOX-SMCK

\$305 kit

Cat. No. IMS-IOX-SMCA

Shared Memory Buffer Board

\$113 kit

Cat. No. IMS-IOX-SMBK

\$175 assembled

Cat. No. IMS-IOX-SMBA

Shared Memory Terminator Board

\$98 kit

Cat. No. IMS-IOX-SMTK

\$148 assembled

Cat. No. IMS-IOX-SMTA

CABLE H 18''

cable for Shared Memory Buffer Board

\$45

Cat. No. IMS-CAB-CABH

CABLE Z 6''

cable for Shared Memory Buffer Board

\$45

Cat. No. IMS-CAB-CABZ

Note: All shared memory configurations must be reviewed by IMSAI.

INTERFACE BOARDS TO LET THE COMPUTER COMMUNICATE WITH INPUT/OUTPUT DEVICES

* Serial I/O Interface SIO 2-2

\$156 kit

Cat. No. IMS-IOX-SIO22K

\$299 assembled

Cat. No. IMS-IOX-SIO22A

The SIO 2-2 Serial I/O Interface board contains two identical ports, each permitting the computer to communicate with most peripheral devices through an RS232 or current loop interface. The two ports are independent. Each may operate through either the current loop or RS232 mode, and will operate in full-duplex or half-duplex with all control signals.

You can run synchronous or asynchronous lines, full- or half-duplex, at any baud rate up to 9600 baud (asynchronous) or 56,000 baud (synchronous). Baud rates up to 9600 (asynchronous) or 38,400 (synchronous) are selected by jumpers on the board. Asynchronous baud rates are 75, 110, 150, 300, 600, 1200, 2400, 4800 and 9600. Synchronous rates are 1200, 2400, 4800, 9600, 19,200 and 38,400. Other rates are made possible using the SIOC board which mounts directly on the SIO board.

Control lines for each input include DSR, DTR, RTS, CTS and Carrier Detect. RS232 receivers and drivers are also provided for clocks in synchronous operations. Jumpers permit using the board as either the receiving (terminal) end of a communication line or the originating (computer) end.

Each interface is structured around an Intel 8251 USART chip. This chip allows extensive program control of I/O functions including control line and sync character selection, and error-condition sensing and recovery. The board generates interrupts for received characters, transmitter buffer empty, transmitter empty or sync character. A jumper selects the priority interrupt (acknowledged by the computer only if it includes the PIC-8 Priority Interrupt board). All functions may be program-controlled so that you can use the full capability of the board without using interrupts.

The board may be jumper-adapted to respond either to I/O instructions from the IMSAI 8080 system or to memory reference instructions for memory-mapped I/O.

If you need to change the data for-

mat or protocol in an RS232 line, you can easily connect an IMSAI 8080 in the line to intercept, process and retransmit the data. That's because jumper facilities let you use both of the serial I/O ports, with control lines connected together.

Connector fingers on the upper edge of the board accommodate two flat cables (CABLE A) to connect directly to 25-pin EIA-type connectors, one for each port. No hand wiring is required to receive or originate an RS232 line.

An edge connector EXPM is needed to install the SIO 2-2 board. One or two cables (CABLE A) are optional.

Serial I/O Interface Board SIO 2-1 \$125 kit

Cat. No. IMS-IOX-SIO21K

\$235 assembled

Cat. No. IMS-IOX-SIO21A

This is, essentially, an SIO 2-2 board containing chips for a single port. You can add another port later with the SIOM module.

Serial I/O Module SIOM

\$47 kit

Cat. No. IMS-PTS-SIOMK

\$69 assembled

Cat. No. IMS-PTS-SIOMA

This set of components adds the second I/O port to an SIO 2-1 board.

Serial I/O Clock Board SIOC

\$31 kit

Cat. No. IMS-IOX-SIOCK

\$59 assembled

Cat. No. IMS-IOX-SIOCA

This piggyback board attaches to a SIO board to provide any non-standard baud rate from 1 baud to 56K baud. The SIOC board is needed for each port using a non-standard baud rate.

* Parallel I/O Interface PIO 4-4

\$156 kit

Cat. No. IMS-IOX-PIO44K

\$299 assembled

Cat. No. IMS-IOX-PIO44A

Use the Parallel I/O board as a custom TTL-level interface to peripheral devices.

The board provides four 8-bit input ports, and four 8-bit output ports. Each input and output port has its own latch and hand-shaking logic for conventional parallel transfer.

Hand-shaking logic on any I/O port will generate an interrupt, with the priority level of the interrupt selected on the board. (Note that the processor will not respond to the interrupt unless the computer contains the PIC-8 Priority Interrupt board.)

The ports are addressed by four sequential addresses jumper-selected to be in the 256 I/O address space. You may also address the board with memory-mapped I/O, using normal memory read or write instructions to transfer data through the I/O ports.

The Parallel I/O board includes a set of eight LED's for each output port (32 total). You'll find this useful for debugging, monitoring system activity, or replacing the front panel in dedicated

applications. Mount a photographic mask, with appropriate legends, over the LED's to form a readable display. The front panel can still be used during development by plugging it into another slot.

The board includes an IC regulator for the +5V supply, with tantalum capacitor filters on either side of the regulator. There is ample ceramic disk capacitor bypassing throughout the board.

You can take +5V power (up to 300 mA total) from the +5V and ground pins on the I/O port connectors of a fully utilized board. For each unused port, an additional 100 mA may be drawn from the board. If, for example, you are using four output ports and only two input ports, 500 mA is available from the board.

On the top of the board, fingers accommodate two 50-pin connectors (25 pins per side on 0.1-inch centers), one for input ports, and one for output ports.

An edge connector EXPM is needed to install the Parallel I/O board. PIO cables for input and output are optional.

Parallel I/O Board PIO 4-1

\$93 kit

Cat. No. IMS-IOX-PIO41K

\$140 assembled

Cat. No. IMS-IOX-PIO41A

This is a PIO 4-4 board containing components for one 8-bit input and one 8-bit output port. Expand it later with 1, 2 or 3 sets of components by adding PIOM sets. Requires edge connector EXPM. PIO cables for input and output are optional.

Parallel I/O Module PIOM

\$22 kit

Cat. No. IMS-PTS-PIOMK

\$39 assembled

Cat. No. IMS-PTS-PIOMA

This is a set of components to add a single port to a PIO 4-1 board.

Multiple I/O Board MIO

\$195 kit

Cat. No. IMS-IOX-MIOK

\$350 assembled

Cat. No. IMS-IOX-MIOA

Contains 2 parallel, one serial and one control ports and BYTE/TARBEL tape cassette interface. (order one to three CABLE A's and one or two CABLE M's)

Programmable 6-port Parallel I/O Board PIO6-6

\$169 kit

Cat. No. IMS-IOX-PIO66K

\$279 assembled

Cat. No. IMS-IOX-PIO66A

Requires two CABLE R's and one CABLE S

Programmable 3-port Parallel I/O Board PIO-3

\$139 kit

Cat. No. IMS-IOX-PIO63K

\$239 assembled

Cat. No. IMS-IOX-PIO63A

Requires one CABLE R and one CABLE S

*Kit is standard stock item

Programmable 3-port Parallel Expansion Module PIO6M

\$54 kit

Cat. No. IMS-IOX-PIO6MK

Cat. No. IMS-IOX-PIO6MA

Disk Drive Interface HDIF

\$3,900

Cat. No. IMS-IOX-HDIF

This interface enables the connection of a Disk-50, -80 or -200 drive to an IMSAI 8080 computer.

* Cable PIO Cable

\$29

Cat. No. IMS-CAB-PIOCAB

This cable connects parallel I/O signals between the Parallel I/O board and the rear of the IMSAI 8080 chassis. An edge connector attaches to the upper edge of the board and the cable divides into two 25-pin EIA-type female connectors which attach to the rear of the chassis.

One PIO CABLE is used for all inputs and a second for all outputs.

General Purpose Interface Cables

* Cable A

\$18

Cat. No. IMS-CAB-CABA

CABLE A is a 15-inch, flat ribbon cable to carry signals from an interface board to a female 25-pin EIA-type connector (included) attaching to the rear of the chassis. A card edge connector (included) on the other end attaches to the pc board. Use CABLE A with SIO, FIF and LIF interface boards.

* Cable C

\$25

Cat. No. IMS-CAB-CABC

CABLE C is a 5-foot ribbon cable for carrying signals between the rear of the IMSAI 8080 cabinet to a peripheral device, such as a floppy disk drive, modem or terminal. The cable has a male 25-pin EIA-type connector at each end.

* Cable M

\$12

Cat. No. IMS-CAB-CABM

Cassette recorder interface cable assembly from MIO board to rear of chassis.

Cable R

\$35

Cat. No. IMS-CAB-CABR

Cable for 3 ports of a PIO's board, 50 pin from board to peripheral device, 5 feet.

Cable S

\$25

Cat. No. IMS-CAB-CABS

Cable for data and address lines from a PIO's board, 26 pin, from board to peripheral device, 5 feet.

See page 39 for IMSAI books.

PERIPHERAL DEVICES FOR DATA INPUT, STORAGE, PRINTING AND DISPLAY

Floppy Disk Drive

The Floppy Disk Drive is recommended for high-speed, mass data storage. Each disk stores up to 243K bytes of data, with average access time of 100 milliseconds.

The IMSAI Floppy Disk Drive is available in a desk-top cabinet or in a rack-mount package. The drive is built on a rugged, compact casting, and uses positive pressurization and self-contained air filters to assure continued reliability. The read/write heads retract automatically to reduce wear.

The front panel of the drive contains a number of indicators, including READY and SELECTED. For the selected drive these indicate:

- The head is at track zero.
- Write operation is in progress.
- Head is loaded on the disk.
- Disk is physically write-enabled.

A phase-lock-loop data separator is provided in each cabinet for increased reliability. The IMSAI 8080 system permits you to connect up to four disk drives through a single interface, giving you a total mass storage capacity of more than one million bytes.



Specifications

Unformatted Capacity

Per flexible disk: 3.2 million bits/400K bytes

Per track: 41.7K bits/5K bytes

3740 Format Capacity

Per flexible disk: 1.9 million bits/243K bytes

Per track: 26.6K bits/3.3K bytes

Per sector: 1024 bits/128 bytes

Transfer Rate: 250K bits per second (nominal)

Track Density: 48 tracks per inch (0.021-in. track width)

Positioning Times

Access: 6 ms track-to-track

Head Stabilization: 10 ms

Head Load: 16 ms

Motor Start to Ready: 2 sec maximum

Rotational Speed: 360 rpm $\pm$ 2.4% (167 ms/rev.)

Positioning Mechanism: Stepping motor, electrical detent

Media: IBM 3740 Diskette or IMSAI-approved equivalent

Dimensions: Same as IMSAI 8080 computer

Reliability

Read Error, soft: Less than 1 in 10^9 bits

Read Error, hard: Less than 1 in 10^{12} bits

Positioning Error: Less than 1 in 10^6 accesses

MTBF: Better than 5000-hr

MTTR: Less than 30 min

Component Life: More than 10,000 hours on all components

Heat Dissipation: 275 BTU/hr

Dual Drive Cabinet with One Drive FDC 2-1

\$1,295 assembled

Cat. No. IMS-DSK-FDC21

This is a dual-drive cabinet containing one disk drive with power supply and phase-lock-loop. Order a CABLE C to connect it to the computer chassis or, if this is a second Floppy Disk Drive cabinet, to connect it to the first cabinet.

Dual Drive Cabinet with Two Drives FDC 2-2

\$2,390 assembled

Cat. No. IMS-DSK-FDC22

Two floppy disk drives and power supplies, phase locked loop, table top cabinet one Cable C required.

Rack Mount Hardware FRM

\$20 assembled

Cat. No. IMS-PTS-FRM

This is hardware permitting the disk drive cabinet to mount in a standard 19-inch electronics rack. It consists of side panels that bolt to the inside of the electronics cabinet and a special dust cover. Order the rack mount option only in conjunction with an FDC 2-1.

Floppy Disk Drive FDC

\$1,095 assembled

Cat. No. IMS-DSK-FDC

Disk drive and power supply to add a drive to the dual-drive cabinet FDC 2-1. Includes a cable to interconnect drives within the cabinet.

Floppy Diskette FDD

\$15 assembled

Cat. No. IMS-SUP-FDD

The recording medium for the Floppy Disk Drive. Equivalent to IBM 3740 Diskette.

Floppy Disk Interface FIF

\$599 kit \$399*

Cat. No. IMS-DSK-FIFK

\$799 assembled \$599*

Cat. No. IMS-DSK-FIFA

*If ordered with FDC 2-1 or FDC 2-2

The FIF board is an interface/controller consisting of an IFM (Interface Master Board) and a FIB (Floppy Disk Interface board) which interface the disk to the computer.

The combination of FIB and IFM

*Kit is standard stock item

boards creates an intelligent controller including DMA transfer, which permits the computer to perform other tasks during disk operations.

The IFM board uses its own 8080A processor which is programmed to support the floppy disk system. The program is stored in 1K byte EPROM chips and can be changed to support different data formats and densities on the floppy disk drives. Included is a disk bootstrap capability that reads and executes the contents of the first disk sector, allowing the disk operating system to gain control after turning on the computer.

A single FIF interface will control up to four disk drives in a daisy chain signal bus, and can write-protect drives under software control. Commands include Read Clock and Data Bits, Write Sector, Read Sector, Verify Sector, Format Track, Write Deleted Data Sector Mark, Write Protect, Write Enable and Restore Drive.

Logical and physical track addresses may be different. Cyclic redundancy checks are performed automatically. When an error is detected in reading or writing, the logic automatically retries up to 10 times.

The FIF board is furnished with a CABLE A to connect the board to the rear of the computer chassis and a CABLE C to connect the chassis to the Floppy Disk Drive cabinet.

Two edge connectors EXPM are required.

Serial Printer PTR-30A

\$2,895 assembled
Cat. No. IMS-PTR-PR30A

Serial Printer with tractor-feed, PTR-30A-TF

\$3,220 assembled
Cat. No. IMS-PTR-PR30AT

This serial printer produces letter-quality copy and will operate in the plot mode to produce graphs. Print fonts are changeable, and two-color ribbons are available.

The printer operates at a rate of 30 characters per second, using the Hy-Type I daisy-wheel printer mechanism. It will space up, down, right or left. Tabs are program-controlled and operate at high speed in either direction. The platen is 132 characters wide.

The printer includes a power supply. A software driver program listing is furnished with the printer to facilitate normal character printing and plotting. The driver routine uses about 512 bytes of memory.

The required interface is the PIO 4-1 with an installed Parallel I/O Module (PIOM) and two PIO cables.

A 10-foot round cable is furnished to interconnect the printer with three male 25-pin EIA-type connectors to the rear of the computer chassis.

Specifications

Print Speed: 30 characters per second (average text)
Character Set: 96 characters
Print Line: 132 columns
Form Width: 15 inches maximum
Carriage Return Time: 400 ms maximum for 132 columns
Tabulation: Right and left, direct to column address
Tabulation Speed: 400 ms maximum for 132 columns
Column Spacing: 60 positions per inch (nominal)
Paper Feed: Bidirectional
Paper Feed Spacing: 48 positions per inch (nominal)
Paper Feed Speed: 4 inches per second plus 50 ms settling delay
Dimensions: 8½ in. high, 22½ in. wide, 13½ in. deep
Weight: 30 lb

Tractor Feed Option PTR-30A-TF

This option for the PTR-30A printer provides greater paper control when using multipart forms. It also provides better registration when backing-up a line and overprinting.

Line Printer PTR-300A

\$2,610 assembled
Cat. No. IMS-PTR-PR300A



The Line Printer prints up to 314 lines of 80-column material per minute. The unit is ruggedly built and produces a high-quality copy on standard fan-folded or rolled forms from 4 to 9¾ inches wide. Multipart forms may have up to six parts. Form width and length are operator-adjustable to permit the printer to handle a variety of forms.

The standard USASCII 63-character set is provided. Character spacing is 10 characters per inch and 6 lines per inch, operator-adjustable to 3 lines per inch.

The printer mechanism uses individual type pallets in an endless revolving carrier belt. This system gives you high-speed operation along with the good character quality and changeability advantages of an impact typebox printer.

Automatic Character Substitution: The printer may be made to print either the upper-case equivalent of a received lower-case character, or the substitute character ¶.

Parity Error Indication: The printer prints the substitute character for a character received with an even parity

error. The printer is easily changed to operate with odd parity or none.

Test Character Generation: A switch inside the printer may be used to test the printer mechanism by printing the substitute character ¶ in all printable positions of consecutive lines.

The printer includes power supply and a 10-foot flat cable terminated by a 25-pin EIA-type connector which connects to the rear of the computer chassis. The required interface for the Line Printer is the Line Printer Interface board set (LIF).

Line Printer PTR-300B

\$3,656 assembled
Cat. No. IMS-PTR-PR300B

This line printer is 132 columns wide and in all other respects equivalent to Line Printer PTR-300A. The maximum paper width is 14¾ inches. Requires interface board set LIF.

Line Printer Interface LIF

When ordered with printer PTR-300A or B

\$599 kit \$399*
Cat. No. IMS-IOX-LIFK

\$799 assembled \$599*
Cat. No. IMS-IOX-LIFA

*When ordered with printer PTR-300A or B

The LIF interfaces the Line Printer to the computer. It consists of an Interface Master (IFM) board and a Line Printer (LIB) board. The combination of LIB and IFM boards creates an intelligent controller including DMA transfer, permitting the computer to perform other tasks during printer operations.

The IFM board uses its own 8080A processor which is programmed to support the printer. The program is stored in 1K byte PROM chips.

The LIF board is furnished with a CABLE A to connect the board to the rear of the computer chassis and a cable to connect the chassis to the Line Printer.

Requires two edge connectors EXPM.

Serial Printer AP-44

\$399 kit
Cat. No. IMS-PTR-AP44K

\$549 assembled
Cat. No. IMS-PTR-AP44A

SOFTWARE FOR DEVELOPING YOUR PROGRAMS

(available only to owners of an IMSAI Basic computer system)

Software now available includes a monitor/executive (Self-Contained System), Tape Cassette Operating System, Disk Operating System, three BASIC language interpreters and bootstrap loaders for paper tape and tape cassette.

*Self-Contained System PGM-1A

\$14 paper tape
Cat. No. IMS-SOF-1APT

\$20 cassette¹
Cat. No. IMS-SOF-1AC

\$100 EPROM²
Cat. No. IMS-SOF-1AE

This package contains an assembler, editor, debugger, loader and monitor. It has commands to modify memory, dump memory contents, manage memory-located files, list a file, execute a program and use breakpoints.

Programs are read from paper tape by a bootstrap loader program keyed into the computer at the front panel or by a bootstrap on an EPROM card (PGM-4A). The entire package is memory-resident and requires 4K bytes of memory plus 2K bytes for buffers. Generally, at least 8K of memory is needed to store the package and user-created programs.

The package is furnished on paper tape with source listing, along with the basic computer system. It is also available on tape cassette and diskette. The Tape Cassette Operating System also provides the package in EPROM, for use with or without the tape cassette and its interface.

Operating instructions and source listings are contained in the IMSAI 8080 User's Manual.

*Tape Cassette Operating System PGM-2A

\$20 cassette¹
Cat. No. IMS-SOF-2AC

\$100 EPROM²
Cat. No. IMS-SOF-2AE

This package contains a version of the Self-Contained System and includes features for reading and writing files stored on a tape cassette in HIT format, and for loading programs from the cassette. The operating system resides in 4K bytes of EPROM at a high memory address. It is also available on paper tape, tape cassette, and diskette. The system may be used with or without the tape cassette facility.

Use of this system requires at least 4K bytes of random access memory (RAM 4A-4), and requires use of a PROM 4-4 board. If the tape cassette recorder is to be used, a UCRI-1 board is also required.

*Paper Tape Bootstrap Loader PGM-4A

\$15 EPROM²
Cat. No. IMS-SOF-4A

This is an EPROM bootstrap loader for paper tape programs. It enables a paper tape for any software package to be automatically read by starting the computer at a specified address. This eliminates keying in the bootstrap program at the front panel. A PROM 4-512 board is required to accommodate this function.

*Tape Cassette Bootstrap Loader PGM-5A

\$15 EPROM²
Cat. No. IMS-SOF-5A

This is an EPROM bootstrap loader for tape cassette stored programs written in the HIT format. With this feature other IMSAI software may be purchased on tape cassette and readily loaded by starting the computer at a specified address. A PROM 4-512 board is required.

Advanced Self Contained System PGM-6A

\$40 paper tape
Cat. No. IMS-SOF-6APT

\$200 EPROM²
Cat. No. IMS-SOF-6AE
includes source listing

Disk Operating System DOS-A

\$50 diskette
Cat. No. IMS-SOF-DOSA

This powerful Disk Operating System works in association with the IMSAI Floppy Disk Drive and interface system. It permits you to create and access files on disk from assembly-language programs, extended BASIC or a keyboard.

DOS-A is interactive and can be used for overall system control.

Valuable program-development tools include an assembler to produce relocatable code, a linking loader, a new debug program, and a symbol-oriented text editor.

*BASIC Language Interpreter BASIC-4A

\$14 paper tape
Cat. No. IMS-SOF-B4APT

\$30 cassette¹
Cat. No. IMS-SOF-B4AC

\$100 EPROM²
Cat. No. IMS-SOF-B4AE

This compact yet powerful high-level interpretive language requires only 4K bytes of memory. An additional minimum 1K bytes are required for the user's program. This software is available on paper tape, tape cassette, EPROM and diskette. If you choose EPROM you will need to buy a PROM 4-4 board.

Here's a brief specification:

Statements	Functions
IF ... THEN	RND
READ	SQR
DATA	ABS
INPUT	INT
PRINT	SGN
LET	Operators
GOTO	+
GOSUB	-
RETURN	=
FOR	/
NEXT	Commands
RESTORE	LIST
REM	NEW
RANDOMIZE	RUN
STOP	
END	

Other features:

Direct execution of any statement when line number is omitted

- Line numbers from 1 to 9999
- Two-character error code. Example: NX ERROR AT LINE 20
- Results are calculated to precision of six decimal digits.

BASIC Language Interpreter BASIC-8A

\$28 paper tape
Cat. No. IMS-SOF-B8APT

\$40 cassette¹
Cat. No. IMS-SOF-B8AC

\$200 EPROM²
Cat. No. IMS-SOF-B8AE

This is an expanded version of the BASIC-4A package and requires 8K bytes of memory plus at least 1K byte for the user's program.

BASIC-8A is available on paper tape, tape cassette, EPROM and diskette. If you choose the program on EPROM, you will need two PROM 4-4 boards.

The package includes all the statements and features of BASIC-4A plus the following:

Functions

INP	CHRS
TAB	INSTR\$
SIN (radians or degrees)	SPACES
COS	NUM\$
TAN	STR\$ or STRINGS
CSC	Statements
SEC	ON ... GOTO
COT	ON ... GOSUB
ARC/SIN or ASN	DIM
ARCCOS or ACS	CHANGE
ARCTAN or ATN	DEF
LOG (base e or base 10)	OUT
EXP	Commands
LEN	CONTINUE
VAL	LOAD
ASC or ASCII	PUNCH
LEFT\$	CLEAR
RIGHT\$	SCRATCH
MID\$	

+ (string concatenate)

Other features include:

- IF ... THEN may be followed by any statement, even another IF. For example: IF A=B THEN PRINT A,B.
- Handles strings, string vectors and arrays with length to 255 characters.
- Handles multiple statements per line, separated by \.
- Statements, commands and functions can be abbreviated to three characters.
- \$ may be omitted from string functions.
- OUT will write to any IMSAI 8080 port; IN will read a byte.

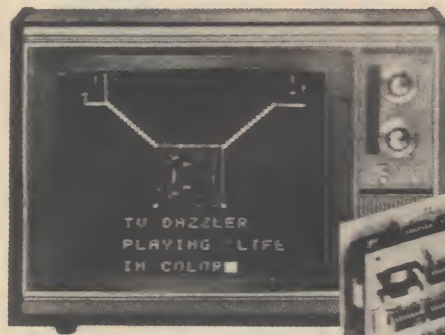
Notes: 1) A tape cassette is included in the price of the cassette software. Specify BYTE or TARBELL standard.

2) The charge is for programming the PROMs. Order PROM 4-512 for PGM-4A and PGM-5A; order correct number of PROM 4-4 for other EPROM software.

*Most economical version is standard stock item.

CROMEMCO

NCE has Cromemco peripherals for your microcomputer



- inexpensive
- unbelievably versatile
- beautiful displays of computer games
- for hobbyists
- for engineers
- for educators
- for business

TV Dazzler™

... a microcomputer interface that lets a color TV be your computer display terminal

Cromemco's new computer/TV interface circuit lets you have a full-color computer display terminal for little more than a black-and-white terminal.

The Cromemco interface also lets you do vastly more with your color terminal than you can do with ordinary black-and-whites.

We call our interface the TV Dazzler™. It consists of two circuit boards that plug directly into your Altair 8800 or IMSAI 8080 computer.

TECHNICAL SPECIFICATIONS DAZZLER

DISPLAY FORMAT: 128 x 128, 64 x 64, or 32 x 32 (software selectable).
 COLORS AVAILABLE (COLOR MODE): Red, green, blue, cyan, magenta, yellow, white, black.
 GRAY-SCALE AVAILABLE (B&W MODE): 16 intensities.
 SYSTEM MEMORY REQUIRED: 2K bytes (512 bytes for low resolution mode).

MEMORY ACCESS: DMA.
 DMA RATE: 1 Megabyte/second.
 VIDEO OUTPUT: Composite video TV signal.
 BUS: S-100 (two slots required).
 POWER REQUIREMENTS: +8 volts @ 1.4 A
 -18 volts @ 50 mA
 OPERATING ENVIRONMENT: 0 - 55°C.

As low as \$215

TV Dazzler Kit Cat. No. CRO-IOX-DAZLRK \$215

TV Dazzler assembled CRO-IOX-DAZLRA \$350

LIFE in full color, Cat. No. CRO-DOC-LIFE \$15
 KALEIDOSCOPE in full color, Cat. No. CRO-DOC-KALSCP \$15
 DAZZLE-WRITER (for alphanumeric displays in color), Cat. No. CRO-DOC-DAZWR \$15
 DAZZLE-MATION (for computer-generated animated

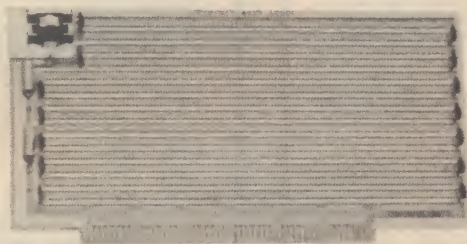
displays), Cat. No. CRO-DOC-DAZLMN \$15
 TIC-TAC-TOE (you play the computer), Cat. No. CRO-CAS-TCTCTO \$15
 SPACE WAR*, Cat. No. CRO-CAS-SPWAR \$15
 4D TIC-TAC-TOE, Cat. No. CRO-CAS-4DTTTO \$15

TANK WAR, Cat. No. CRO-CAS-TNKWAR \$15
 CHASE*, Cat. No. CRO-CAS-CHASE \$15
 TRACK*, Cat. No. CRO-CAS-TRACK \$15
 DAZZLE-DOODLES*, Cat. No. CRO-CAS-DAZDDL \$15

PROGRAMS ARE ON PAPER TAPE

*need Joystick - see below

Wire Wrap Board



A high-quality wire wrap board for building your own cards for the Altair 8800 or IMSAI 8080 computers. Will hold over 70 integrated circuits. A 5-volt power supply is included on the board. Uses tantalum decoupling capacitors and disc ceramic bypass capacitors. Edge contacts are gold-plated for long, trouble-free life.

Wrap Board kit (CRO-IOX-WWB2K).....\$35
 Wrap Board assembled (CRO-IOX-WWB2W)...\$45

Extender Card

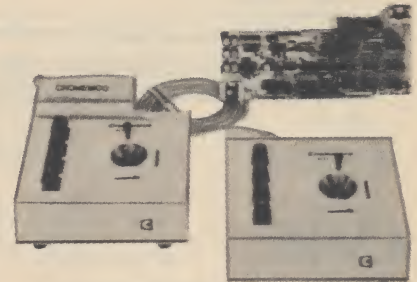
The card you need when experimenting with or trouble-shooting the Altair 8800 or IMSAI 8080 computers. Extends computer boards above case for easy connection of voltmeter, logic probe, or oscilloscope. Compatible with all Altair/IMSAI boards. Edge contacts are gold plated for long, trouble-free life.

Connector is included

Extender Card kit (CRO-IOX-EXC2K).....\$35
 Extender Card assembled (CRO-IOX-EXC2W)...\$45

EASY TO COUPLE

To couple the new joystick to your computer, just use our D+7A™ I/O board. It will couple not only one but two consoles to your Altair™ 8800 or IMSAI 8080. And you'll still have several analog channels left over (and one 8-bit output port). The D+7A plugs into the Standard 100 (S-100) bus of your Altair or IMSAI computer.



Joystick Console with Speaker \$65 kit

Cat. No.

CRO-IOX-JSIK

\$95 assembled

Cat. No. CRO-IOX-JSIA

TECHNICAL SPECIFICATIONS JS-1 JOYSTICK CONSOLE

JOYSTICK:

Degrees of freedom: 2 axes (X and Y), spring return to center.
 X axis output voltage: ±2 volts, center 0 volts.
 Y axis output voltage: ±2 volts, center 0 volts.

SWITCHES:

Number of switches: 4
 Output switch depressed: 0 volts
 Output switch open: +5 volts

AMPLIFIER/SPEAKER:

Input voltage range: -2.56 to +2.54 volts
 Output: 47-ohm internal speaker

GENERAL INFORMATION:

S-100 bus interface: use Cromemco D+7A I/O.
 Power requirements: +5 volts @ 50 mA
 +18 volts @ 40 mA
 -18 volts @ 40 mA
 Operating environment: 0 - 55°C

TU-ART digital interface

\$195 Cat. No. CRO-IOX-TUARTK kit

\$295 assembled Cat. No. CRO-IOX-TUARTA

For interfacing with

- CRT terminals
- line printers
- modems
- other devices

SERIAL I/O PORTS:

Number of ports: 2.
 I/O levels: RS-232 or 20 mA current loop.
 Low baud range: 110 - 9600 baud (software selectable)
 High baud range: 880 - 76,800 baud (software selectable)

PARALLEL I/O PORTS:

Number of ports: 2
 Input ports: 8 bits
 Output ports: 8 bits
 Input load: one TTL equivalent
 Output drive: 20 TTL loads

INTERVAL TIMERS:

Number of timers: 10
 Timer range: 0 - 16.32 msec (software selectable).
 Timer resolution: 64 microseconds

VECTORED INTERRUPTS:

Number of restart locations (8080 mode): 8
 Number of restart locations (Z-80 mode): 65,536
 Prioritization of TU-ART ports: internally prioritized
 Prioritization for multiple TU-ARTs: daisy-chaining

GENERAL INFORMATION:

UART type: 5501
 Bus: S-100
 Power requirements: +8 volts @ 1.0 A
 +18 volts @ 80 mA
 -18 volts @ 40 mA
 Operating environment: 0 - 55°C.

Z-2 Computer System



TECHNICAL SPECIFICATIONS Z-2 COMPUTER SYSTEM

Processor: 4 MHz version Z-80
Cycle time: 250 nanoseconds
Minimum instruction execution time: 1 microsecond
Instruction set: 158 instructions including the 78 instructions of the 8080
System bus: industry standard S-100
Board capacity: 21 boards
Power supply: +8 volts @ 30A, +18 volts @ 15A, -18 volts @ 15A
Power: Operates from 110/220 volts; 50/60 cycles.
Operating environment: 0-55°C
Dimensions: 12 1/4" H x 19" W x 20 3/4" D (31.1 x 48.3 x 52.7 cm)
Weight: 39 lbs (18 kg)
Mounting: For rack mounting (optional bench cabinet available)

Price: Z-2 kit (CRO-COM-Z2K) \$595
 Z-2 assembled (CRO-COM-Z2A) \$995

See what only \$595 kit buys

This new Cromemco Z-2 Computer System provides the engineer, businessman, educator or experimenter with the industry's fastest and most powerful microcomputer in an economical package for dedicated work. The Z-2 makes available Cromemco's fast Z-80 microprocessor card and a 21-card motherboard in a form such that an almost endless variety of memory, I/O and other peripherals can easily be plugged in — thereby forming a computer tailored to your particular job whether in the laboratory, on the production line, or in an educational time-sharing setup.

Z-2 System

Here are some of the leading features you get in the new Cromemco Z-2 Computer System:

- The industry's fastest μ P board (4 MHz or 250-nanosecond cycle time).
- The power and convenience of the well-known Z-80 microprocessor chip.
- A full-length shielded motherboard with 21 card slots to let you plug in almost any conceivable combination of memory, I/O, or your own custom circuits.
- An extremely heavy duty power supply providing 30A from +8V and 15A from +18 and -18V. This will not only power a full set of 21 cards but also has ample additional power for other peripherals such as a floppy disk drive.
- Power-on jump circuitry to begin automatic program execution when power is turned on.
- S-100 bus — important because it is widely supported by a host of peripherals manufacturers. Thus you get the widest possible array of compatible peripherals.
- All-metal chassis and dust case.
- Card retainer that secures cards in sockets.
- Standard rack-mount style construction suited to dedicated applications. Upward compatible with larger systems. Usable with a variety of cabinets. Bench cabinet optional.
- 110 or 220-volt operation.

Rack/Cabinet mounting

The basic Z-2 is supplied in a black-anodized metal case for mounting in a standard 19-inch relay rack. A quality stylized bench cabinet in an attractive blue color is also available.

Cat. No. CRO-ENC-Z2CASE \$195

4 MHz CPU card

- Uses special Z80 microprocessor
- Fast—4 MHz clock rate
- Does not require front panel for operation



Z80-CPU kit (CRO-CPU-ZPUK) \$295
 Z80-CPU assembled (CRO-CPU-ZPUW) \$395

ALTAIR/IMSAI COMPATIBLE WITHOUT MODIFICATION

Yes, the new CPU is plug-compatible with the Altair 8800 and IMSAI 8080. Just remove the existing CPU, plug in the Z80/CPU, and you're up and running.

INCLUDES FREE SOFTWARE

The CPU comes with our powerful Z-80 monitor, complete documentation, source code, and paper tape object code. The monitor is also available in PROM (\$50) for use in our BYTESAVER or 16 KPR memory boards.

TECHNICAL

PROCESSOR: 4 MHz version of the Z-80.
CLOCK RATE: 2/4 MHz (switch selectable).
INSTRUCTION SET: 158 instructions including the 78 instructions of the 8080.
POWER-ON JUMP: jumper wire enabled.
POWER-ON JUMP LOCATIONS: 16 locations switch selectable.
WAIT STATE GENERATION: 0-4 wait states jumper wire selectable.
M1 WAIT STATE: jumper wire selectable.
BUS: S-100.
POWER REQUIREMENTS: +8 volts @ 1.1 A.
OPERATING ENVIRONMENT: 0-55°C.

Software



• **BASIC.** Cromemco 3K Control BASIC is a compact integer-only BASIC interpreter designed specifically for microcomputer control applications. Control BASIC allows the user to read and write specific memory and I/O locations and call machine language subroutines. There are 36 commands and functions available:

CALL	NEXT	TO
EPROM	NULL	WIDTH
FOR	OUT	ABS
GOTO	PRINT	AND
GOSUB	PUT	GET
IF	QUIT	IN
INPUT	RETURN	LOC
LET	REMARK	OR
LIST	RUN	RND
LOAD	SAVE	SIZE
LOCK	STEP	SGN
NEW	STOP	XOR

Control BASIC requires 3K of memory space beginning at location E400. It is available on paper tape (Model CB-PT) or in 3 2708 PROMs (Model CB-308).

Model CB-PT paper tape \$15

Cat. No. CRO-DOC-CBPT

Model CB-308
 in 3 2708 PROMs \$150

Cat. No. CRO-DOC-CB308

• **MONITOR.** The Cromemco Z-80 Monitor is a powerful tool for use in software development. It allows the user to examine and alter register and memory contents, set program break points, move blocks of memory, program PROMs (using the Cromemco BYTESAVER), and read and punch paper tapes — all under keyboard control.

There are 12 Monitor commands:
 DSPM READ MOV
 DSPR WRIT OUT
 SUBM GO PRGM
 SUBR GO (breakpoints) VRFY

The Monitor resides in memory space from E000 to E3FF and is available on either paper tape (Model ZM-PT) or in one 2708 PROM (Model ZM-108).

Model ZM-PT paper tape \$15

Cat. No. CRO-DOC-ZMPT

Model ZM-108 in 2708 PROM . . . \$50

Cat. No. CRO-DOC-ZM108

• **ASSEMBLER/RESIDENT OPERATING SYSTEM.** The Cromemco assembler and resident operating system allows the user to create and edit Z-80 source code, assemble the source code, and create object code files. There are 43 operating system commands:
 CFIL NFOR WBIN ENTE PSTA
 LFIL AUTO RBIN MOVE STAB
 CURR RENU WCBN VMEM ASMB
 DFIL DELE ECBN PRAM ASMC
 VFIL LIOD RCBN BANK ASMU
 MFIL IODR WCHX ECUS EXEC
 LIST DIOD ECHX LCUS PROM
 TEXT SYSI RCHX DCUS
 FORM LEAD DUMP RENA

The assembler/resident operating system resides in memory space from address A000 to BFFF. It is available on paper tape (Model ZA-PT) or in 8 2708 PROMs (Model ZA-808).

Model ZA-PT paper tape \$30

Cat. No. CRO-DOC-ZAPT

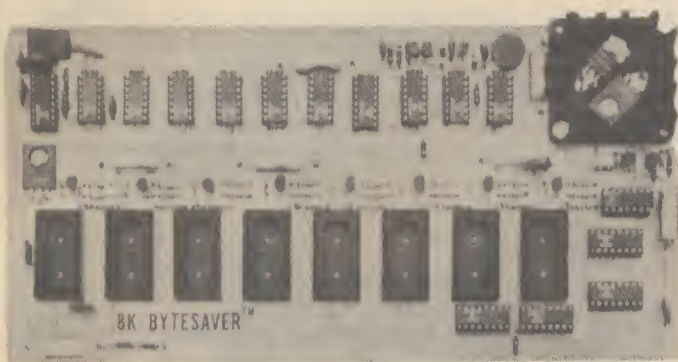
Model ZA-808
 in 8 2708 PROMs \$400

Cat. No. CRO-DOC-ZA808

LOW cost Memory and Interface Boards

BYTESAVER Memory Board and PROM Programmer

As low as \$145



Cromemco's popular BYTESAVER™ memory board gives you two of the most-wanted features in microcomputer work:

- (1) a simple, easy way to store your computer programs in program-mable read only memory (PROM).
- (2) A PROM memory board with the capacity for a full 8K bytes of PROM memory storage.

The BYTESAVER™ itself plugs directly into your Altair 8800 or IMSAI 8080 and of course into the Cromemco Z1 and Z2.

BYTESAVER™ kit
(Model BSK-O) \$145
CRO-MEM-BTSVRK

BYTESAVER™ assembled
(Model BSK-W) \$245
CRO-MEM-BTSVRA

TECHNICAL SPECIFICATIONS BYTESAVER

MEMORY CAPACITY: 8K bytes.
MEMORY TYPE: 2708 PROM or equivalent.
MEMORY ACCESS TIME: 450 nano-seconds.
WAIT STATES AT 2 MHz: none required.
WAIT STATES AT 4 MHz: one per machine cycle.
BUS: S-100.
POWER REQUIREMENTS: +8 @ 0.5 A
+18 @ 0.4 A
-18 @ 0.2 A
OPERATING ENVIRONMENT: 0 - 55°C.

PROMs are not included with BYTESAVER™. 2708 PROMs are available at \$50 each.

Cat. No. CRO-MEM-2708BM

Bytemover program PROM
CRO-DOC-BTMVR4 \$25

D+7AI/O™ Multi-channel microprocessor analog interface

\$145 kit Cat. No. CRO-IOX-D7AIOK



\$245 assembled
Cat. No. CRO-IOX-D7AIOA

Now you have a way to get analog information into and out of your micro-computer. It's an easy, fast, and unbelievably inexpensive way.

It's Cromemco's new D+7ATM high-performance I/O module which gives you:

- 7 channels of 8-bit analog-to-digital conversion (to input analog data to the computer)
- 7 channels of digital-to-analog conversion (to output computer data in analog form)
- an 8-bit parallel I/O port to input and output data in digital form.
- a fast conversion time of 5.5 microseconds.

NO FURTHER SOFTWARE NEEDED

The D+7A I/O plugs directly into the Altair 8800 or IMSAI 8080 micro-computers. Analog signal range is from -2.56 to +2.54 volts (20-millivolt increments) on both input and output sides.

Simple "Input" and "Output" instructions initiate A/D conversion and read in or out the ensuing 8 bits of data. No further software is required.

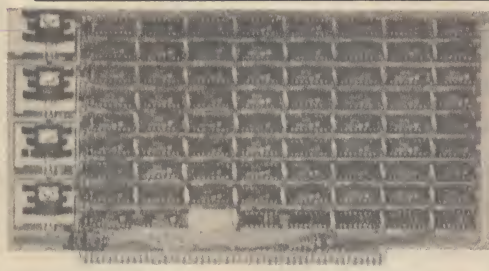
TECHNICAL SPECIFICATIONS D+7A A/D & D/A INTERFACE

ANALOG INPUT PORTS:
Number of input ports: 7
Input voltage range: -2.56 to +2.54 volts
Input bias current: 2 microamps max.
Input impedance:
20 Megohms || .001 µF,
1 kHz sample rate.
2 Megohms || .001 µF,
10 kHz sample rate.
Resolution: 8 bits.
Conversion time: 5.5 microseconds
Accuracy: ±20 millivolts
ANALOG OUTPUT PORTS:
Number of output ports: 7
Output voltage range: -2.56 to +2.54 volts
Output impedance: 0.25 ohm.

Maximum load current: 1.5 mA
Resolution: 8 bits
Conversion time: 5.5 microseconds
Accuracy: ±20 millivolts
Drift rate: Less than 10 mV/sec at 25°C

PARALLEL I/O PORT:
Input port: 8 bits
Output port: 8 bits
Input load: one TTL equivalent
Output drive: 10 TTL loads

GENERAL INFORMATION:
Bus: S-100.
Power requirements:
+8 volts @ 0.4 A
+18 volts @ 30 mA
-18 volts @ 60 mA



8KSC

Cat. No. SEA-MEM-8KSCK \$269 kit
Cat. No. SEA-MEM-8KSCKA \$369 assembled

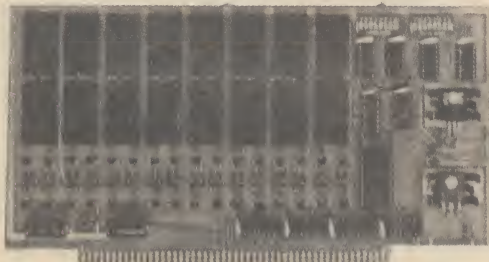
Cat. No. SEA-MEM-8KSCZK \$295 kit
Cat. No. SEA-MEM-8KSCZA \$395 assembled

8KSC-Z

- Will accept up to 16 ea. 1702A or 5203 EProm Providing up to 4096 Words of non-volatile memory for Boot Loads to Complete Programs.
- Programming Available at Factory for \$3.00 per EProm when accompanied by binary formatted tape.
- Each 1702-A has its own Vgg clocked for Low power Consumption. Will work with the weakest power supply based S-100 buss computer.
- Switched Selected Address in 4K Blocks.
- Switch selected wait states so that even the slowest 1702-A can work in your system. 0-8 wait states.
- Solder masked on both sides of PC Board.
- Component Screened on Component Side of PC Board.

Same Specifications as for 8KSC Card Except:

- Access Time: 250 nsec max.
- Zilog Speed Compatible up to 4 mhz.
- Memory Chip: 2102LHPC or 2102AL-2



4KROM

Cat. No. SEA-MEM-4KROMK \$119 kit
Cat. No. SEA-MEM-4KROMA \$179 assembled

- ALTAIR®, IMSAI®, and S-100 buss compatible.
- Access Time: 50 nsec max.
- Memory Chip: AMD 91L02APC
- Battery Standby: 1.5 to 4V
- Address Select: 8 ea. SPST Dip Switch
- Wait States: None
- Current Reg.: Less than 200 ma per 1K.
- All Address, Control, and Data Out lines fully buffered.
- All IC's supplied with IC Sockets
- Solder masked, both front and back of P.C. Board
- Component silk-screened on component side of card

SEALS



NCE's got it! Z-80 power for the Altair/IMSAI bus.

TDL's ZPU

**\$269
kit**

Here it is, TDL's ZPU the highest point of technology for an Altair/IMSAI system. Now, you can multiply your present capabilities without creating costly obsolescence. Take advantage of the wide range of existing hardware backup for your current system. The ZPU is compatible and dependable with many plus features you'll want to know about.

The Z-80 offers you the greatest power of any micro-158 instructions, 696 opcodes, 22 registers, single voltage power requirements, and static operation allowing clock speeds from DC up to 4MHz or greater. (NOTE: Zilog is not yet certifying Z-80 operation above 2.5 MHz. Most Z80s operate up to 4MHz. When certifies 4MHz parts are available they will be included in the ZPU.)

ZPU, Cat. No. TDL-CPU-ZPU, kit **\$269**
assembled and tested **\$345**

the Z-80 System Monitor Board As low as \$295

This single board, in conjunction with your processor and memory, provides all the support that your system needs to get up and running in a sophisticated but easy to use configuration.

Using other boards to duplicate the functions of the System Monitor Board isn't easy — it requires at least 4 other boards, several hundreds more dollars in cost, and a good bit of expertise to create an equivalent fully integrated operating system. The System Monitor Board does it for you.

Z-80, Cat. No. TDL-IOX-Z80, kit **\$295**
assembled and tested Cat. No. TDL-IOX-Z80A **\$395**

Z16 — the most advanced memory module available / 16K for \$574

It is loaded with more features and more versatility than any other memory on the market ... at a price that makes it a real bargain. TDL has the fastest and lowest power static ram boards going. Full 16K memory on one cad.

16K, Cat. No. TDL-MEM-Z16K **\$574**

Note: Due to high demand, we cannot ship the system Monitor Board or Z16 on an immediate basis.

Software - TDL's user support program is unmatched in the micro industry

Zapple Monitor

Designed to allow the user the maximum is versatility and system executive control. It is capable of supporting 4 logical devices (Console, Reader, Punch and List Device) each of which supports 4 alternate I/O devices including N number of user defined devices. The reader and punch may be any device - cassette, memory, disk, etc.

It is also efficient, providing 27 commands (3 of which are user defined) while occupying only 2K of core. Additionally, ZAPPLE is relocatable, romable, and expandable due to its modular organization. The documentation includes the complete source listing as well as a comprehensive user guide.

Text Editor

A most versatile tool for both the programmer and the word processor.

Both line and character oriented; it features an internal pointer that can be moved through the text line by line and character by character. Wherever the pointer is located, both characters and lines may be inserted, deleted or changed at will, in both forward and backward directions.

Like all TDL software, the Zapple Text Editor is relocatable, uses either the Zap or Zapple Monitors for its I/O handling, and is supplied on paper tape complete with a user guide.

Text Output Processor

A WORD-PROCESSOR for the Z-80 system. It occupies 3K of core. It is used in conjunction with the Text-Editor and Monitor to provide a POWERFUL word-processing capability.

The Processor has numerous commands which you simply enter into the text while you are editing. Then, you take the output of the editor, run it through the Processor, and its output will be formatted EXACTLY as you have commanded.

The variety of possible applications for this sort of word processing power are limited only by your imagination.

Macro-Assembler

TDL's relocating macro-assembler is by far the most sophisticated programming tool yet developed for a micro-processor. In terms of number of functions, scope of abilities, and usefulness, it has no comparison.

Zapple Basic

Here's something you've been waiting for — Zapple Basic! It can hold its head up among the finest Basic interpreters ever written - backed by the speed and power of the Z-80. And it works ...

Zapple Basic occupies 8K of core and utilizes the I/O handling of the Zap or Zapple Monitor routines. Therefore you get unequalled I/O handling versatility and a large degree of hardware independence. Of course, Zapple Basic is relocatable — so you can load it anywhere in memory. (Minimum loading address 200 hex - to allow a fixed buffer from 100H to 1FFH.)

Super Basic

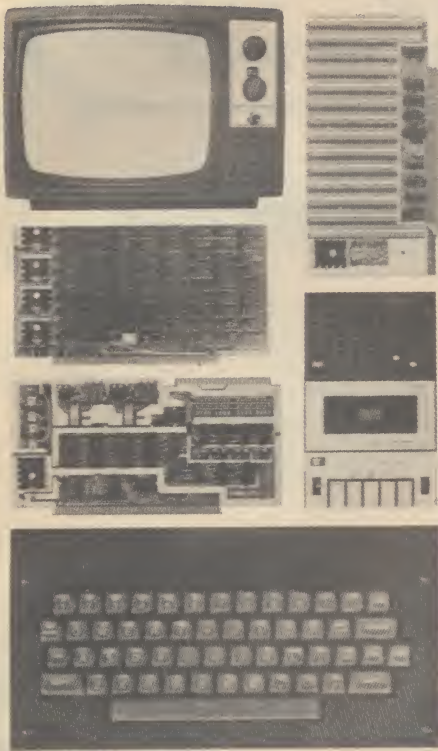
One of the latest additions to the fantastic software offerings by TDL is their new Z-80 SUPER-BASIC. This is a powerful 12K Basic Interpreter which has all the features of ZAPPLE 8K BASIC and many more.

Zapple Monitor, Cat. No. TDL-DOC-ZMPT	paper tape \$25
Cat. No. TDL-DOC-ZMC	 cassette \$20
Text Editor, Cat. No. TDL-DOC-TEPT	paper tape \$35
Cat. No. TDL-DOC-TEC	 cassette \$30
Text Output Processor, Cat. No. TDL-DOC-TOPPT	paper tape \$50
Cat. No. TDL-DOC-TOPC	cassette \$40
Macro Assembler, Cat. No. TDL-DOC-MAPT	 paper tape \$50
Cat. No. TDL-DOC-MAC	 cassette \$40
Zapple Basic, Cat. No. TDL-DOC-ZBPT	 paper tape \$50
Cat. No. TDL-DOC-ZBC	 cassette \$40
Super Basic, Cat. No. TDL-DOC-SBDT	 paper tape \$95
Cat. No. TDL-DOC-SBC	 cassette \$79

need System Monitor Board to use cassette

Please write for information on the NEW Xitan Alpha Series of S-100 micros

NCE has the LOW Cost Poly 88 Microcomputer System



"The first computer system to be integrated into a personal tool"

FROM \$525

System 0: is a kit to make any S-100 computer Poly compatible. Consists of CPU board with monitor, Video Terminal Interface and cassette interface.
Cat. No. POL-COM-SYS0.....\$525

System 2: is a kit which adds a Poly 88 chassis to System 0 components.
Cat. No. POL-COM-SYS2.....\$735

System 6: is a kit which upgrades System 2 with the addition of 16K memory, keyboard, 11K BASIC and Assembler tapes.
Cat. No. POL-COM-SYS6.....\$1575

System 12: is an assembled version of System 6 without the 16K memory.
Cat. No. POL-COM-SYS12.....\$1175

System 16: is the complete Polymorphic system. It is an assembled version of System 6 with a TV monitor and a cassette recorder added. Just plug it in and go!
Cat. No. POL-COM-SYS16.....\$2250

Fan Kit for Poly (POL-PTS-FANK)...\$35

Options Available Separately

Printer Interface for Systems 2, 3, or 4; (RS-232 or current loop); kit, Cat. No. POL-IOX-PTR \$45

Cassette Interface for system 1; includes USART package; kit, Cat. No. POL-IOX-CASS \$90

Software (on cassette tape)

Assembler, Cat. No. POL-DOC-ASMBLE \$15

8K BASIC, Cat. No. POL-DOC-8KBAS \$15

11K BASIC, Cat. No. POL-DOC-11KBAS \$15

11KBAS\$15

S-100 Compatible Kits

Video Terminal Interface 64 character line, Cat. No. POL-IOX-VDT64\$210

Video Terminal Interface 32 character line, Cat. No. POL-IOX-VDT32\$185

Memory option for 32 character line to convert to 64 character line, Cat. No. POL-IOX-MO32\$25

Prototype board (POLY I/O Ideaboard), Cat. No. POL-IOX-PROBD\$155

Video Terminal Interface Manual, Cat. No. POL-DOC-VDTM\$5

SPECIFICATIONS

Chassis

Power Supplies: +9V at 6A, +18 at 0.75, -18 at -.25A (unregulated) per chassis.

Number of cards: 5

Compatibility: Accepts POLY 88/IMSAI/Altair cards.

Bus Connector Type: Power switch, reset button, halt indicator and power indicator.

Cabinet Dimensions: 4 1/4" w X 6 3/4" h X 17" d.

Expandability: Up to 4 chassis may be plugged together.

Processor Card

Processor Type: 8080A

Clock: Crystal controlled 1.853MHz.

Number of Instructions: 78 with 244 variations.

CPU Registers: 10

Addressing Modes: Direct, immediate, register, register indirect.

Addressing Range: 65,536 bytes of memory and 256 ports.

Interrupts: 8 level vectored.

Real Time Clock: 50/60 Hz (reference to line frequency).

Bus Loading: Outputs drive 30 TTL loads, inputs are 1 TTL load or less

Power Requirements: +8 to 10V at 1.2 amps max., +16 to 20V at 200 mA. Max., -16 to 20V at 140 mA. max. (inc. 3 2708 EPROM).

RAM: 512 bytes 500 nsec. access time.

ROM: Sockets provided for 3K bytes of EPROM or (2708 type) ROM.

Serial I/O Port (option)

Baud Rate: Software controlled 12.5 to 9600 baud (asynchronous) 800 to 57,600 baud (synchronous).

Data Format: 5, 6, 7, or 8 bits with or without parity.

Ports: Can handle up to 2 minicards.

Power Requirements: +8 to 10V at 150 ma, -16 to 20V at 35 ma.

Video Terminal Interface

Character Font: 7 X 9 matrix alphanumeric and 6 element graphic characters.

Character Set: 96 character ASCII plus 32 special characters.

Number of Characters: 512 (1024 optional), 32 (64) characters per line with 16 lines.

Graphic Resolution: 64 (128) horizontal by 48 vertical.

Video Output: Composite video negative sync.

Required Video Bandwidth: 2.5 MHz for 32 characters, 5.5 MHz for 64 characters.

Input Port: 8-bits plus positive or negative strobe.

Power Requirements: +8 to 10V at 1.25A typ., +16 to 20V at 30 ma max., -16 to 20V at 20 ma max., not including keyboard requirements.

Byte/PolyPhase Cassette Interface

Baud Rate: 300, 600 (Byte); 1200, 2400 (Polyphase).

Connector (to recorder): Standard 25 pin "D" type female Mating connector type=DB-25p or equivalent.

Connector type (to CPU): 14 wire ribbon cable with DIP plug termination.

Power Requirements: +5 ±0.25 VDC at 150 ma max., -5 ±0.15 VDC at 20 ma max.

Input: Approximately 2Vp-p into 15

Motor Controls: (2) will switch up to 200 mA at up to 30V (negative ground).

8K RAM

Storage Capacity: 8192 X 8 bits

Memory Type: 91L02 or equivalent.

Access Time: 500 ns. max.

Address Decoding: Switch selectable in 8K increments.

Memory disable: Controlled by bus pin 67 (PHANTOM).

Power Requirements: +8 to +10 at 2.6A max. +2.2V at 1.5A max. (standby).

Poly I/O Ideaboard

I/O Addressing: Blocks of four addresses.

Power Requirement (excluding user added components): +8 to 10V at 370 mA. max.

Firmware Monitor

Size: 1K bytes in 2708 type read-only memory ROM or compatible mask programmed ROM.

Operation: Fits in zero-addressed CPU ROM socket. Runs on system power-up or front panel reset.

Functions: Tape loader for Byte standard or Polyphase encoded Polyformat absolute binary cassette files. Front panel simulator program produces register and memory display on system video display. Commands allow register, memory modification, program interrupt and single step or return to interrupted program.

Utilities: Routines for teletype simulated I/O on the memory mapped video display, character fetching from system keyboard, hexadecimal conversions, real time clock.

Features: "Wormholes" allow reassignment of I/O devices independent of program I/O handling. Video driver recognizes TAB, FORMFEED, BACKSPACE, LINE ERASE, VERTICAL TAB and CARRIAGE RETURN. Address of video display is reassignable. Interrupts handled through a vector table which allows re-assignment of service routine addresses. Real time clock has 2 year delay capability with automatic execution of preset task on timeout.

PolyMorphic Systems 11K BASIC

Size: 11K bytes.

Scientific Functions: Sine, cosine, log, exponential, square root, random number, x to the y power.

Formatted Output

Multi-line Function Definition

String Manipulation and String Functions

Real-Time Clock

Point-Plotting on Video Display

Arrays of up to 7 Dimensions

Cassette Save and Load of Named Programs

Multiple Statements per Line

Renumber

Memory Load and Store

8080 Input and Output

If Then Else

Commands: RUN, LIST, SCR, CLEAR, REN, CONT, LINE, NULL

Statements: LET, IF, THEN, ELSE, FOR, NEXT, GOTO, ON, EXIT, STOP, END, REM, READ, DATA, RESTORE, INPUT, GOSUB, RETURN, PRINT, FILL, OUT.

Built in Functions: FREE, ABS, SGN, INT, LEN, CHR\$, VAL, STR\$, ASC, SIN, COS, RND, LOG, TIME, WAIT, EXP, SORT, CALL, EXAM, INP, PLOT.

Systems Available. The POLY 88 is available in either the kit or assembled form. It is suggested that kits be attempted only by persons familiar with digital circuitry.

Specifications subject to change without notice.



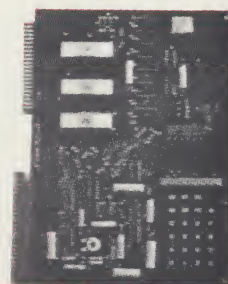


Complete Programmable Control

KIM-1 COMPUTER

Just **\$245**

See page 40



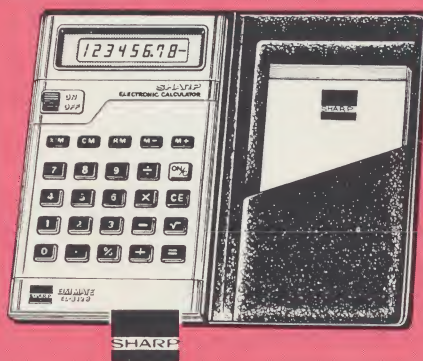
WALLET CALCULATORS

• Super Slim Design

Large easy read 8 Digit LCD Display can be seen even under the brightest lighting conditions. New long life (1200 hour) batteries eliminates the need for a Recharger/Adaptor. Packed in a handsome wallet.

8028: percentage key with add-on & discount. Square root key. Constant.

8128: Same as 8028 plus a direct access 4 Key Memory with indicator. Either unit guaranteed for one year parts and labor. Nationwide Service.



\$19.95

Cat. No. SHA-ACC-8028

\$24.95

Cat. No. SHA-ACC-8128

EL 5804 SCIENTIFIC SLIMLINE

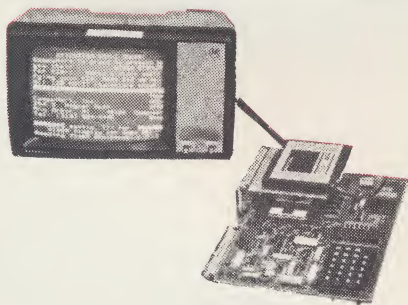


The industry's thinnest scientific. Shaped like a sliderule and loaded with features including: 8 Digit LCD display, full direct access memory, logs, sine, cosine, tangent, ARC, PI, square root, reciprocals, 2 digit exponent, degrees & radians, change sign. 1200 hour battery. With carry case.

\$35.95 Cat. No. SHA-ACC-5804

SUPPLY SALE

see page 32



CRT Display for your KIM-1

Page 42



Visit Our Retail Store in Ann Arbor



- We stock DEC (LSI-11), IMSAI, Mos Technology (KIM), Cromemco, Polymorphic Systems, Lear Siegler, OAS, Seals, North Star Computers, Electrostatics, Hycom, Matrox, Continental Specialties Corp., Technical Design Labs, Vector

- Everything in this catalog available for sale (and lots more we haven't space to list)
- Over 100,000 pounds of Inventory stocked

Bring a truck – you won't be able to resist our prices

- Special unadvertised sales running continuously
- See our new items before they are advertised
- Qualified sales people to help you
- Our library of computer books for sale is unsurpassed
- Try out our demonstrators
- Visit the 'game room'
- Sign up for courses in introduction to computers, hardware, software, construction, and applications.

It's worth a special visit. A computer happening!

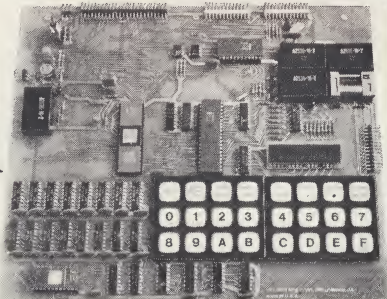
Ann Arbor is famous for a lot of things and we're trying to add another. Our store will have the same meaning to computer enthusiasts as does Michigan Stadium to football fans; the home of Champions. Please come see us.

See overleaf for map to our store

**Hours: Mon-Fri 9-7
Sat 10-6**

Introducing IMSAI 8048 Single Board Control Computer.

See page 35



FOR YOUR ALTAIR/IMSAI or other S-100 bus computer

**High Resolution Graphics for
the Altair/IMSAI S-100 Bus \$395**

Total control over a field of 65,536 individually addressable locations.

page 44

CRT controllers for the IMSAI/ALTAIR S-100 BUS.

**16K, 32K, and 65K Memory for your IMSAI,
Altair, or other S-100 bus computers**

See page 53

WE FEATURE THE KIM-1

See overleaf

Be on our mailing list.

Fill out the NCE
Action Request
in the centerfold.

PLEASE REROUTE IF NECESSARY

This important announcement should go to the person who uses minicomputers, or to, the nearest related job function.

Newman Computer Exchange, Inc.
1250 North Main Street
Ann Arbor, Michigan 48104

Ted Nelson
Box 3
Schooleys Mtn., NJ 07870

BULK RATE
U.S. POSTAGE
PAID

ANN ARBOR, MI.
PERMIT NO. 304